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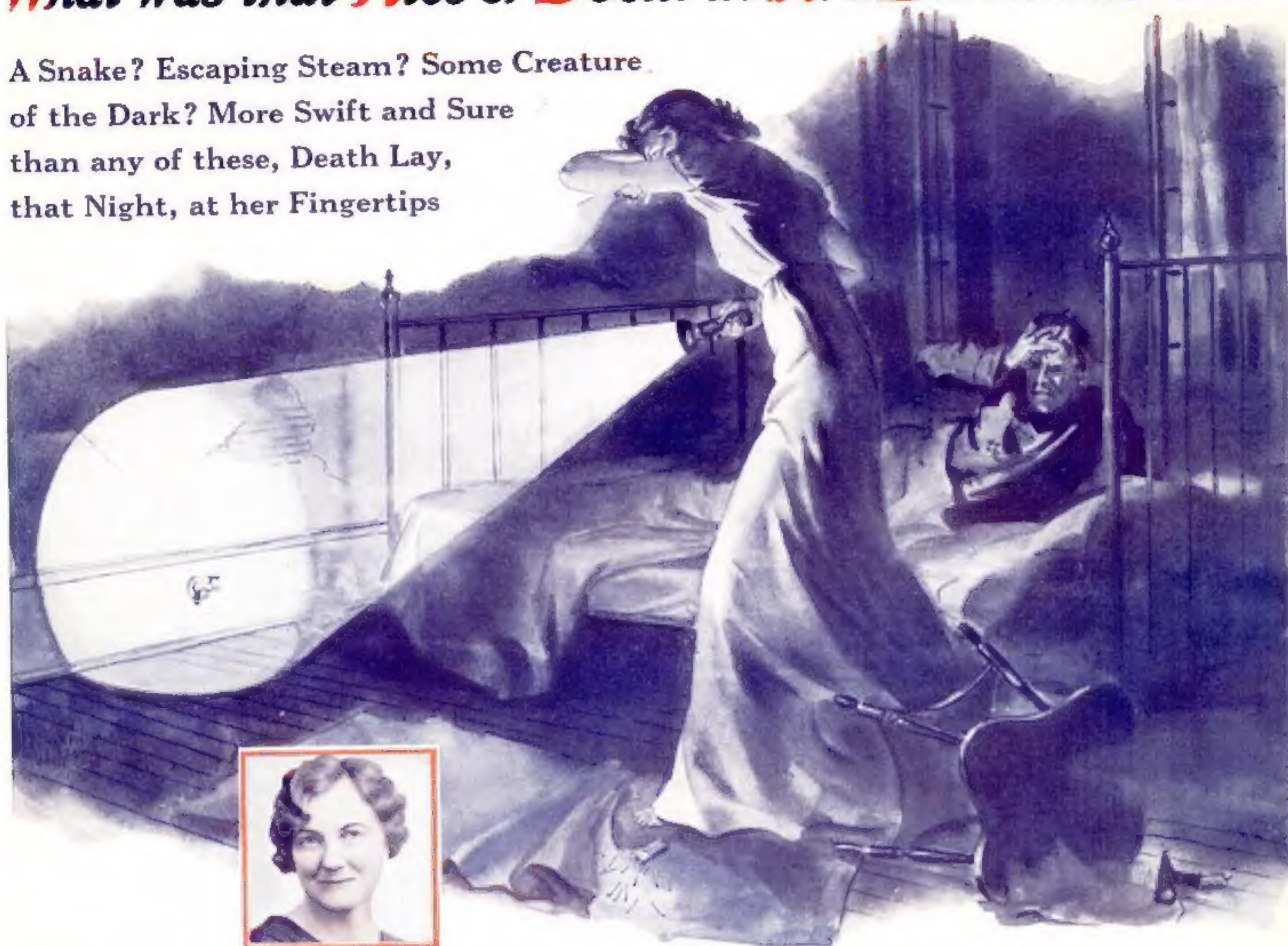


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NEW INVENTIONS • MECHANICS • MONEY MAKING IDEAS
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What was that *Hiss of Doom* in *Mrs. Barton's Room*?

A Snake? Escaping Steam? Some Creature of the Dark? More Swift and Sure than any of these, Death Lay, that Night, at her Fingertips



"I owe you an apology!", writes Mrs. Florence Whitfield Barton (above), of Cisco, Texas. "I thought you really made up those ticklish situations you print in your advertisements where explorers and adventurers and travelers owe their lives to dated Eveready flashlight batteries.* But not any more!

"This summer my husband and I were forced to stop overnight in a little town near the border. The only hotel was close to the railroad track, where a freight locomotive was switching when we went to bed. It was terribly hot, and to get any air at all we had to drag our bed out from the wall and pull it as near the single window as we could. Late in the night I awoke with a splitting headache, caused, I thought, by the heat, and the hissing of the loco-



motive. But after lying awake a few moments, I realized that hissing sound was in our own room. I reached over to the table for (I confess it with shame) a match, and just happened to feel Bart's flashlight, which he always carries in the car. When I switched on the flashlight I saw what had happened: a leg of the bed had opened the gas-cock at the base-board as we dragged the bed away from the wall. The room was full of gas. I shudder to think what would have happened if I had struck that match! Now I am always the one to see that the flashlight is brought out of the car along with the luggage—and that the batteries are fresh.

"You never know when—"

Very truly yours,

Florence Whitfield Barton

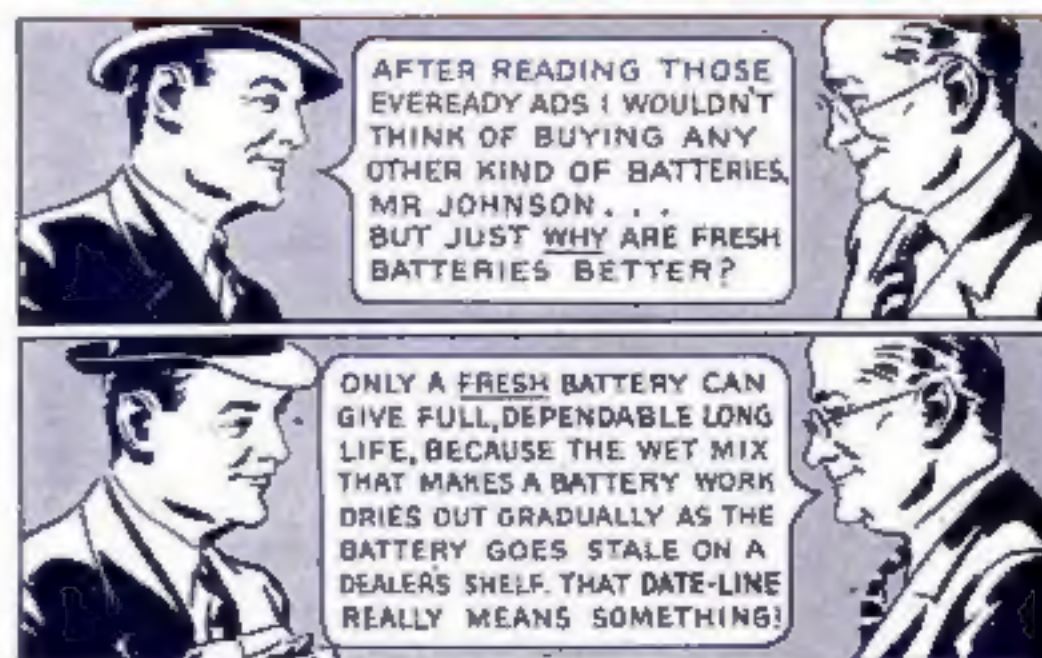
*We don't make them up. All our advertisements of this kind are based upon actual experiences of actual people. They reach us in letters from all over the country. Many appear in the news—your own newspaper frequently carries news items telling how flashlights have saved lives, averted accidents, saved property.



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ROOM TO STRETCH! (above)—Interior measurements are amazing... because every inch is turned into comfortable room. "Chair-height" seats correctly support the body... low floors (no "hump" in rear floor).

(Right)...**MORE ROOM** around pedals, gear shift and steering wheel in the new Safety Interior... in which every detail has been designed for safety and comfort.



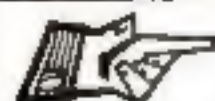
2½" WIDER IN REAR (above)—The biggest Plymouth ever! 3" wider in front... 3" added leg room... 1" added head room... windshield is 3" wider, for greater vision.

Drive this new Plymouth... learn how much more it gives for your money! It's priced at \$510 and up; *all prices list at factory, Detroit (special equipment extra).
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(Below) De Luxe 4-Door Touring Sedan, \$680 list.*

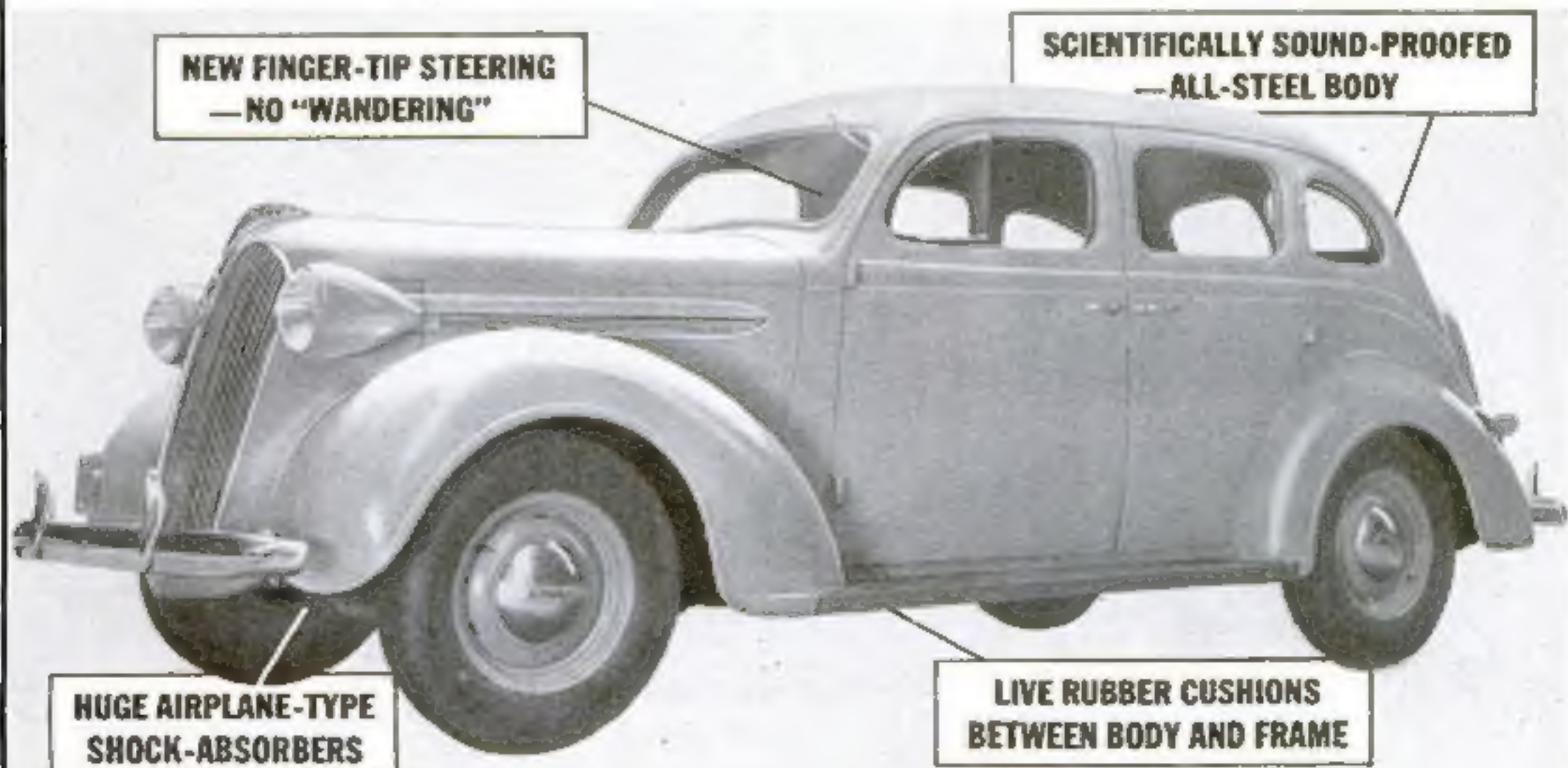
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Wanted: An Expert In Coffee-Dynamics

HERE is a little scientific problem which undoubtedly arises in millions of our homes every morning. Perhaps it is not important, but it does annoy me to see it unexplained. For many years I have noticed, when I make coffee for breakfast, that as soon as the ground coffee is added to the hot water, the boiling increases greatly in violence, and the pot will overflow all over the place if the flame isn't lowered at once. Every housewife knows that this happens, but who knows the reason? All my high-school science has been forgotten long ago, but I have the rudiments of a theory that I would like to have proved or disproved. It is my idea that there is in coffee some essential element which lowers the boiling point of the water just enough to make it boil more violently at the same temperature. Will some expert in whatever branch of science is involved, please find the answer?—Mrs. E.O.C., Baltimore, Md.

HELP, AID,
ASSISTANCE!

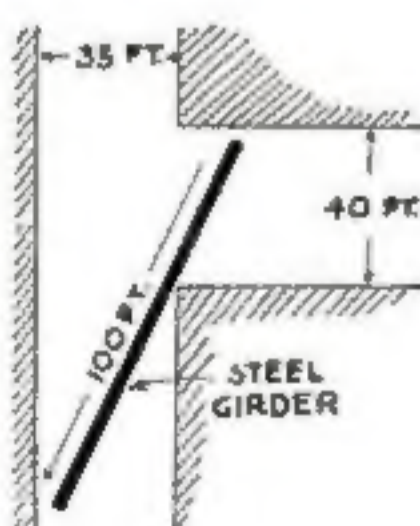


Even on a Steam Engine, You Can't See Steam

IN ANSWER to J.E.T. and C.W.V.; both of these men are interested in seeing steam come from an electric locomotive. Perhaps they will be interested to know that neither of them has ever seen steam. If you will go down in the basement of your home and look at the water-level gauge on the steam boiler, you will see nothing visible above the water level, and thereby prove to yourself that steam is invisible.—E.E., Two Harbors, Minn.

Standing The Girder On End Isn't Fair

OUR "amigo," E.B.L. of Tocophilla, Chile, seems to be a little bit chilly toward the type of problem presented by F.M. in the September issue, because he questions its practicality. It so happens that the principle involved in that problem was put to good use by a contractor who was erecting a steel building in the downtown section of New York City, where many of the streets are quite narrow. He had a 100-foot plate girder to transport from the dock to the building site. It was so heavy that a gang of laborers had to follow the girder, replacing broken manhole covers. In figuring out the shortest possible route for transporting the steel, the contractor encountered a right-angled corner, as shown in the drawing, where one street was thirty-five feet wide, the other, forty feet. Did he get the girder by this corner?—S.A.M., Sykesville, Md.



What Good Is a Safety Device If It Scares You to Death?

IF IT'S just the same to you, I'll stick to old-fashioned passenger planes equipped with regular safety belts, in preference to those that have the new "safety seats" described on page 30 of your January issue. The idea of having a pair of air cushions grip me by the legs at a critical moment just doesn't appeal to me. I can imagine myself aboard a plane flying through heavy weather; the ship starts dropping into a heavy fog, and just as I'm beginning to feel nervous, a pair of mysterious hands grabs me by the thighs. I'd be sure the angels had me already.—K.B., Oshkosh, Wis.

Wants to Print Etchings With Clothes Wringer

JUST to let you know that I am enjoying the magazine as much as ever, I am writing this letter. I think all the departments are improving and would like an article some time in the radio section dealing with the various new types of tubes. You ran such an article about two years ago. The tubes I am interested in especially are the 245, 47, and the still later types, 56, 57, 58, etc. Also, I am very much interested in articles dealing with art work, as I do water color, pen drawing, charcoal, and pastel at times. I would like to try copper-plate etching, but do not know how to make the prints. From the books on such work, I gather that the commercial presses for such work are very expensive. Why don't you give us a working project in the Home Workshop Department on the construction of such a press? Why couldn't a discarded wringer with rubber rolls, such as were used in homes before the advent of the washing machine, be fitted up to print the plates? Any junk yard could supply one.—E.S.D., Middletown, N. Y.

DIS HOUSE SHO
AM HA'NTED!



Plans to Use Trailer As Spare Room

HAVE TAKEN your magazine for many years, and my wife, two grown boys, and I enjoy it very much. We feel quite sure that we have saved thousands of dollars by following your suggestions here and there about the home. Along with the rest of the world, we have become greatly interested in automobile trailers, and look forward to owning one ourselves some day. The type of trailer we have in mind will find additional use, during "off" seasons, as a handy "spare room" in our back yard. We will give "gold-plated" keys to our relatives and friends, so they can go in any time, turn on the lights, use the electric stove, open up the closet for canned goods, and otherwise take full possession. It seems to us that it would provide a fine solution to the week-end guest problem. Now

that we've expressed our idea, how about supplying the plans for a "company room" on wheels?—A.F., Milwaukee, Wis.

Likes Vegetable Raising Better than Trapping

I WOULD be glad to see you give us a series of articles about modern ways of vegetable raising. I see that C.F.L. wants you to publish an article about trapping. You ought to tell about ways of trapping only those animals that are harmful. Other animals should not be destroyed, but protected from extermination by careless hunters and trappers.—A.G., Milford, Conn.

HOW'S THAT?



Perhaps There Were Two Mountain Climbers

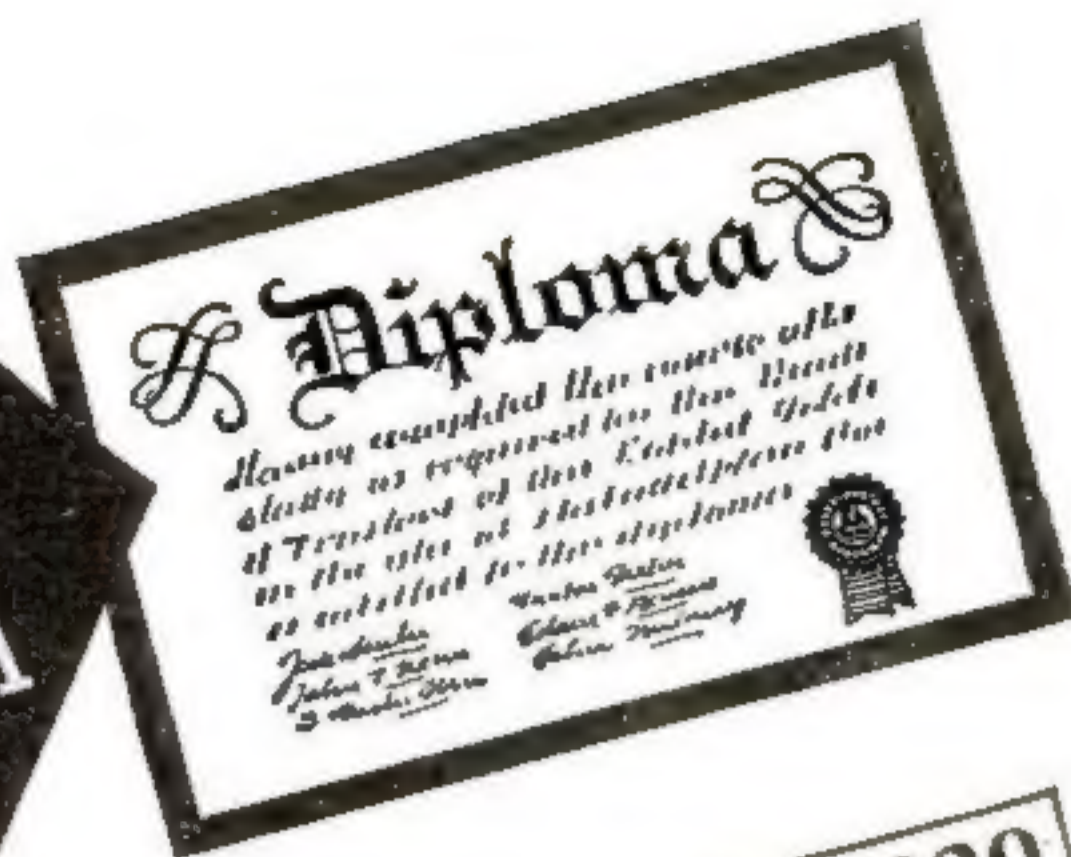
IN THE December issue, J.P. says there is something screwy in the fact that the mountain climber on the cover of the October issue wears no gloves. What is more of a mystery to me is this: who put that rope up above, and fastened it so the man could scale the mountainside? Let's find that out, and then we can worry about the little matter of finding a pair of gloves for him to use.—F.C.C., Flint, Texas.

Not To Mention The Electric Chair

I HAVE been reading P.S.M. for many years, and often marvel at the displays of ingenuity shown in your pages. Most of the inventions you illustrate are all right in their places, but when is some inventor going to develop the perfect chair? True, the furniture makers give us plenty of variety; we have high-backed chairs, wide chairs, narrow chairs, arm chairs, armless chairs, easy chairs, typing chairs, automobile seats, and, worst of all, subway seats, but why can't we have the advantages of all these combined into one? Barber chairs and dentist's chairs are a step in the right direction. My idea is to have a single chair which will accommodate itself perfectly to the sitter's mood. When he comes in to work in the morning, full of pep and ready for a hard day, it would invite an erect, alert posture. As lunch time came around, and the vacant feeling in the worker's innards began to induce a partial collapse in the middle regions, the chair would give a little extra support at the right spot. After lunch, when the worker is in the mood for (Continued on page 8)



TAKE DOWN
THAT DIPLOMA



AND THAT
CALENDAR

— THIS IS 1937!

A DIPLOMA represents a definite course of training, just as a calendar represents a definite period of time, but both lose value when they are out of date. The challenge of 1937 is — modernization of training!

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Mastering an I. C. S. Course is no easy job. (Getting ahead in this competitive world is not easy either!) But to men who have courage and perseverance, I. C. S. stands out as a citadel of opportunity. This coupon is the key to complete information. Take the first step toward modernization — and more money!

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★ Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," ★ and full particulars about the subject *before* which I have marked X:

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☐ Telegraph Engineer
☐ Telephone Work
☐ Refrigeration

☐ Wiring
☐ Radio

☐ Welding, Electric and Gas
☐ Reading Shop Blueprints
☐ Machinist
☐ Patternmaker
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☐ Diesel Engines
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☐ Complete Commercial

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☐ Business Correspondence
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DOMESTIC SCIENCE COURSES

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☐ Home Dressmaking
☐ Advanced Dressmaking

☐ Tea Room and Cafeteria Management, Catering
☐ Millinery
☐ Foods and Cookery

Name.....Age.....Address.....

City.....State.....Present Position.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada

"How I Broke-in an Ornery Pipe"

by **SLIM MURPHY**
Champion Rodeo Rider



You too, can tame the Meanest Pipe

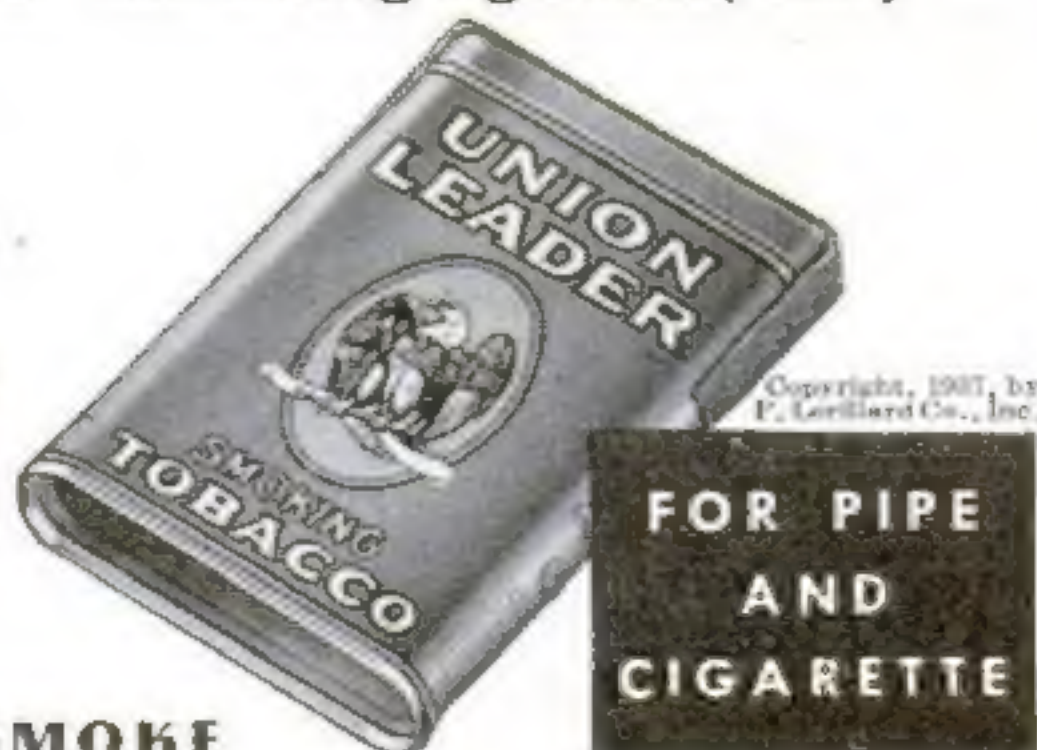
THIS EASY, INEXPENSIVE WAY!

Don't let a back-biting pipe throw you. You can take all the meanness out of it in one shake of a Union Leader tin! The fine fragrant Burley tobacco in that big dime's-worth is "bred in old

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**UNION
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10¢

THE GREAT AMERICAN SMOKE



OUR READERS SAY

(Continued from page 6)

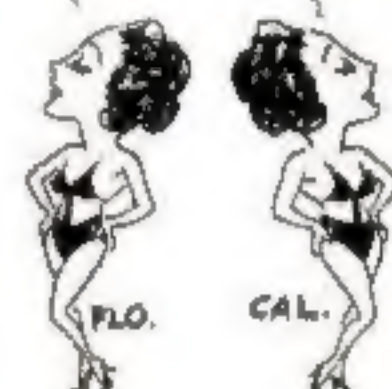
relaxation, the chair would promote a semi-recumbent pose, with a foot support about three feet from the floor. Toward five o'clock, with weariness creeping up on our subject, the chair would arrange itself so as to permit sleeping without being noticed by the boss. Just how all this is to be arranged, I leave to the inventor. A fruitful suggestion would be a delicate relay to be plugged in somewhere in the nervous system. Come on, you inventors, get busy!—A.T.G., Flushing, N.Y.

Says Papaya Is Old Stuff in Florida

IT CERTAINLY WAS interesting to read in your November issue of the wonderful tropical fruit that is being grown for the first time in this country in California. First they invented the avocado, by the simple process of changing its name to calavo. Now they lay claim to the papaya.

We've been growing this fruit as a field crop in Florida for years, and not under glass, either.—H.H.R., Miami, Fla.

H'M, EARTHQUAKES!
YA, TORNADOES!



A Cure for C.A.W.'s Case Of Writer's Cramp

HERE'S a kink that may help C.A.W., of Cincinnati, Ohio, out of his difficulty in making copies of printed matter. It has served me well in many similar cases; I have even copied long scientific articles in this way with quite a degree of success. The requirements are few and materials are available to anyone. First, the subject matter must be so arranged that it will lie perfectly flat. Now place upon this a sheet of, say, No. 3 contact paper of proper size, face down, cover it with a strong sheet of glass, and put on pressure. Expose, through the glass and the back of the photo paper, with a 100-watt bulb for thirty to sixty seconds at eight inches distance, continually moving the lamp about over the exposed area to give even illumination. It is a good idea to make trial exposures for correct time, using small strips of paper, and thereby avoiding waste. Develop as you would any negative, fix, and wash. When this paper negative is dried, any number of positives may be printed from it. Try it, C.A.W. It may be a headache at first, but a little practice will perfect the technique and give your writing hand a rest from copying.—S.T.J., National City, Calif.

"Smaller Model Railroads" Is the War Cry

I'VE JUST stumbled into a bit of news which means a lot to me, as a model railroader. A friend recently showed me the beginnings of his new model railroad, and it's being built in a size smaller than I have ever seen before. They call it "HO gauge." As the name indicates, it is just half the size of the ordinary O gauge. It didn't take me long to learn the reason for making the miniature trains in such a tiny size—it's because you can get so much more into a limited space. In fact, a given track layout takes up only one fourth the room that it does in O gauge. That means that you can get a good oval of track on a kitchen table, a nice layout on a dining room table, and a perfectly swell model railroad system on a table-tennis table! I'm all set, and ready to do things in this small gauge, and as usual, I turn (Continued on page 10)



Be a Radio Expert

Many make **\$30 \$50 \$75** a week

I will train you at home for many Good Spare Time and Full Time Radio Jobs

J. E. SMITH, President, National Radio Institute
The man who has directed the home study training of more men for the Radio Industry than any other man in America.



Set Servicing

Spare time set servicing pays many \$5, \$10, \$15 a week extra while learning. Full time servicing pays as much as \$30, \$50, \$75 a week.

Broadcasting Stations

Employ managers, engineers, operators, installation and maintenance men for fascinating jobs and pay up to \$5,000 a year.



Loud Speaker Systems

Building, installing, servicing and operating public address systems is another growing field for men well trained in Radio.



HERE'S PROOF THAT MY TRAINING PAYS



\$80 Monthly in Spare Time

"I work on Radio part time, still holding my regular job. Since enrolling five years ago, I have averaged around \$80 every month." **JOHN B. MORINETTE**, 773 Silver Street, Manchester, N. H.

Makes \$50 to \$60 a Week

"I am making between \$50 and \$60 a week after all expenses are paid, and I am getting all the Radio work I can take care of, thanks to N. R. I." **H. W. SPANGLER**, 303 Walnut St., Knoxville, Tenn.



Operates Public Address System

"I have a position with the Los Angeles Civil Service operating the Public Address System in the City Hall Council. My salary is \$173 a month." **R. H. HOOD**, R. 136, City Hall, Los Angeles, Calif.

Earnings Tripled By N. R. I. Training

"I have been doing nicely, thanks to N. R. I. Training. My present earnings are about three times what they were before I took the Course. I consider N. R. I. Training the finest in the world." **BERNARD COSTA**, 201 Kent St., Brooklyn, N. Y.



N. R. I. Training Increases Yearly Salary \$1,200

"Since securing my operator's license through N. R. I. Training I've been regularly employed and am now chief engineer with WJBY. My salary has increased \$1,200 in Radio." **JULIUS C. VESSELS**, Station WJBY, Gadsden, Alabama.



Do you want to make more money? Radio offers you many opportunities for well-paying spare time and full time jobs. And you don't have to give up your present job or leave home and spend a lot of money to become a Radio Expert.

Many Radio Experts Make \$30, \$50, \$75 a Week

Radio broadcasting stations employ engineers, operators, station managers and pay up to \$5,000 a year. Spare time Radio set servicing pays as much as \$200 to \$500 a year—full time jobs with Radio jobbers, manufacturers and dealers as much as \$30, \$50, \$75 a week. Many Radio Experts operate their own full time or part time Radio sales and service businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, paying up to \$6,000 a year. Radio operators on ships get good pay and see the world besides. Automobile, police, aviation, commercial Radio, and loud speaker systems are newer fields offering good opportunities now and for the future. Television promises to open many good jobs soon. Men I have trained are holding good jobs in these branches of Radio. Read their statements. Mail the coupon.

There's a Real Future in Radio for Well-Trained Men

Radio already gives jobs to more than 300,000 people. In 1935 over \$300,000,000 worth of sets, tubes and parts were sold—an increase of 20% over 1934! Over 1,100,000 auto Radios were sold in 1935. 25% more than in 1934! 22,000,000 homes are today equipped with Radios, and every year millions of these sets go out of date and are replaced with newer models. Millions more need servicing, new tubes, repairs, etc. Broadcasting stations pay their employees (exclusive of artists) more than \$23,000,000 a year! And Radio is a new industry, still growing fast! A few hun-

dred \$30, \$50, \$75-a-week jobs have grown to thousands in less than 20 years!

Many Make \$5, \$10, \$15, a Week Extra in Spare Time While Learning

Practically every neighborhood needs a good spare time serviceman. The day you enroll I start sending you Extra Money Job Sheets. They show you how to do Radio repair jobs that you can cash in on quickly! Throughout your training I send you plans that made good spare time money—\$200 to \$500 a year—for hundreds of fellows. My training is famous as "the Course that pays for itself."

I Give You Practical Experience

My Course is not all book training. I send you special Radio equipment and show you how to conduct experiments and build circuits which illustrate important principles used in modern Radio receivers, broadcast stations and loud speaker installations. I show you how to build testing apparatus for use in spare time work from this equipment. This 50-50 method of training makes learning at home interesting, fascinating, practical.

You Get a Money-Back Agreement

I am so sure that I can train you successfully that I agree in writing to refund every penny you pay me if you are not satisfied with my Lessons and Instruction Service when you finish. I'll send you a copy of this agreement with my Free Book.

Find Out What Radio Offers You

Act Today. Mail the coupon now for "Rich Rewards in Radio." It's free to any fellow over 16 years old. It describes Radio's spare time and full time opportunities and those coming in Television; tells about my training in Radio and Television; shows you actual letters from men I have trained, telling what they are doing and earning. Find out what Radio offers YOU! MAIL THE COUPON in an envelope or paste on a postcard—NOW!

J. E. SMITH, Pres., National Radio Institute
Dept. 7BP3
Washington, D. C.

THIS FREE BOOK HAS HELPED HUNDREDS OF MEN MAKE MORE MONEY



This Coupon is Good For One FREE Copy of My Book

J. E. SMITH, President, Dept. 7BP3
National Radio Institute, Washington, D. C.

Dear Mr. Smith: Without obligating me, send "Rich Rewards in Radio," which points out the spare time and full time opportunities in Radio and explains your 50-50 method of training men at home in spare time to become Radio Experts. (Please Write Plainly.)

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A FILE FOR EVERY PURPOSE

OUR READERS SAY

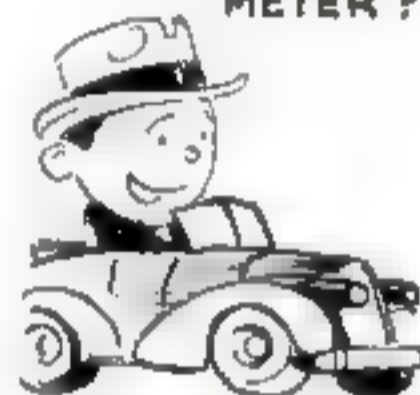
(Continued from page 8)

to my favorite magazine for help. Let's see some articles on HO-gauge model railroading in P.S.M. I'm sure that there are lots of others who, like myself, haven't enough room for an O-gauge layout, but want to get started just the same. HO gauge is our answer. Come on, all you fellows who want HO; let's "gang up" on the editor, and swamp him with letters!—E. K. Akron, Ohio.

If It Measures Distance, It's Not A Speedometer .

I AM glad to see that, in describing a new device that measures the distance a car runs in feet, you do not slip into the common error of calling the distance-measuring instrument of an automobile a "speedometer." There are too many writers who seem to be unaware of the fact that a speedometer gauges only the velocity, or rate of travel; the device that measures the distance covered is an odometer. The mere fact that the two instruments happen to be combined in one unit on an automobile dashboard is no excuse for using such slovenly English. In dealing with bicycles, a new and unnecessary word, "cyclometer," was coined, but it cannot be considered deceptive in meaning. Your treatment of "speedometer" is just another example of the careful editing that makes your magazine the leader in its field. —R.T.S., Oakland, Calif.

HOW ABOUT
SPEE-DO-
METER?



A Note of Irritation From a Piano Tuner

RECENTLY I read a news item describing an electrical device that shows sound waves as an aid for piano tuners. This seems like stretching science a bit. No piano tuner worthy of the name needs any ear crutches. The most difficult part of piano tuning is to set the pins properly, *not* to hear wave or beat forms. Being a piano tuner myself, I would like to say that it is very misleading and dangerous to suggest that anyone with a few weeks' training should attempt to tune a piano, regardless of what mechanical or electrical aids he may happen to have. It takes about ten years of study and actual practice to learn piano tuning. After all, tuning is only part of the job of putting a piano in first-class shape. There is action regulating, voicing (sometimes called "tone regulating") and repairing, all distinct arts and sciences in themselves.—H.W.B., Honolulu, Hawaii.

Asks For More Articles On Making Jewelry

THE ARTICLES on silversmith work and gem cutting by W.T. Baxter fit right in with my occupation and hobby at present. Why not have him continue and give more ideas on this fascinating art? It is simple, and I know that once the idea is embedded in the mind of the craftsman there will be a large demand for this homemade jewelry. I know, because I live in the section where the Navaho Indian jewelry is made and sold, where it was born and developed, exploited and traded, but still I find that I can make it and sell it at fairly decent prices. May I suggest an article? Something about casting silver into the simpler forms, such as simple ring shanks, orna- (Continued on page 11)

OUR READERS SAY

(Continued from page 10)

ments, etc. would help a lot. Casting silver is of interest to every one who has taken up this art. The article should include methods which can be used in the home workshop with a minimum of labor and equipment. It should also deal with the utilization of scrap silver. More and more on this fine art, please.—B.A.R., Albuquerque, N. M.

Perhaps Hollywood Anticipated W.H.'s Suggestion

IN RESPONSE to the letter from W.H. in the December issue, about putting dolls in the movies and altering the positions of the figures for each frame in order to give the illusion of motion, I wish to state that this has already been done both by the Russians in their recent movie of Gulliver's Travels, and also by the folks in Hollywood, in "King Kong." In the latter picture, the fight between the two prehistoric animals, you will remember, was filmed by using small clay figures and a miniature stage. The illusion of motion was created by the means which W.H. puts forth as a new suggestion for the movie makers.—R.B., Ridley Park, Pa.



A Quarter of a Second Should Be Close Enough

IN ANSWER to F.L.M.'s question, given with his snow-shoveling problem in the December issue, there is sufficient data given for a solution of the problem. It began snowing at almost exactly 10:45:50¼ A.M., or very close to one hour, fourteen minutes, and nine and three quarters seconds before noon. This is one of the most interesting little problems that you have published for some time, because it involves a differential equation, which in turn necessitates the solution of a cubic equation. Both are relatively easy to solve, however. If F.L.M. would like to obtain the actual solution of the problem, I will be glad to send it.—E.B.M., Scarsdale, N.Y.

A Bacteriology Fan Germinates an Idea

FOR MONTHS I have been scanning "Our Readers Say," and waiting for someone to ask for a series of articles on bacteriology. I would like some information on how to prepare a culture medium and how to identify colonies of bacteria. I have been reading P.S.M. for years and have found your articles on chemistry and microscopy to be excellent. So come on, fellow scientists, and join in with my plea for articles on bacteriology.—I.F.P., Arcadia, Cal.

Militaristic Model Maker Wants Miniature Forts

HAVING just finished reading "Our Readers Say" in the December issue, I want to second J.T.T.'s request for articles on historic arms and weapons, along with a suggestion of my own. About five years ago, you gave us a model of old Fort Union. Can't you let us have plans for a fort of a different type—say, Ticonderoga, or Fort Amherst, or Fort McHenry? Many of these old forts, or their remains, are still in existence, and it should be easy to work out their plans for us. In closing, I wish to express my appreciation of your magazine, especially the ship models by Captain McCann.—J.J.S., Bethel, Conn.

Are You STILL in the DEPRESSION??

TIMES are better. Business is out of the rut—well ahead of a year ago. Millions of men have gone back to work. There's more money in lots of pay envelopes. But what good is that to you, if your pay check is still written in depression figures?

You weren't so discontented a year ago. In fact, you considered yourself lucky to have a job. But now—you have begun to wonder and worry why the oncoming tide of prosperity hasn't reached you yet. The situation is getting desperate. Bills continue to pile up. You can't get along forever on a "shoe string" budget. You must win back those pay cuts. Other men are doing it—how can you?

Certainly, you can't work any harder than you have been. And it isn't a question of your intelligence, honesty or ambition. Those virtues do not solve today's problem—they are often insufficient to hold down a job, as millions unemployed sadly testify.

But there is a way to get back to the prosperity pay check. A way that's probably far easier than you have dreamed. A plan that has been "depression-tested."

During the worst period of the depression, this plan was helping thousands of men and women forge ahead. Today, during recovery, these same men and women—their ranks swelled by thousands more—are being picked for top positions. They are escaping years of monotonous, routine service—achieving their dreams while they are young enough to enjoy success in its fullest measure.



Since this plan brings results in bad times as well as good, it obviously works independently of business conditions. As unbelievable as that may sound, remember that success is largely up to the individual. Most men struggle through a depression all their lives. The few who forge ahead ride to success the same business tides that sweep the majority to failure.

The LaSalle Success-Building Plan is made for men like you—men with courage, ambition, persistence, who need expert guidance to make the most of their efforts. But LaSalle supplies even more than that. Not only individualized training and coaching to help you meet today's crying needs . . . but also the very steps you need to take to fill the job ahead, and force that pay raise quickly. Any synopsis of this plan we could give here, would give you only an idea of this service. We suggest you mail the coupon for complete details on your own line of work.

Today's Danger

There's real danger to accepting "depression pay" these days. A danger that lower wages will continue to dog you—for no employer will pay more until he is convinced you are worth more. Some day, some way, you've got to convince him. There's no time to lose. The sooner you begin, the better.

If the LaSalle Plan has fulfilled this aim for thousands, isn't it logical to expect it can do as much for you? This coupon can easily become your passport to better times. Mail it today.

LaSalle Extension University, Dept. 283-R, Chicago

I would like to know about your Success-Building Plan and service in the business field I have checked.

- ☐ Business Management
- ☐ Higher Accountancy
- ☐ Traffic Management
- ☐ Modern Salesmanship
- ☐ Commercial Law

- ☐ Law: Degree of LL. B.
- ☐ Expert Bookkeeping
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- ☐ Industrial Management
- ☐ Modern Foremanship
- ☐ Personnel Management

- ☐ Business Correspondence
- ☐ Business English
- ☐ Effective Speaking
- ☐ Office Management
- ☐ Stenotypy

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Two prize winning letters in POPULAR SCIENCE MONTHLY'S new Secrets of Success contest—"What Home Study Has Meant to Me"—are printed below. Read these stories carefully because your own career may be just as interesting and inspiring to other readers. If you think so, put it down on paper and send it in. We will pay \$5 for every letter we publish.

CONTEST RULES

Only letters from bonafide home study school students will be considered and these must contain the name of the school and the name of the company, or companies, for whom you have worked since graduation. (Names, however, will be deleted from the letters when published.) We also want to know the kind of course you took and the type of position you have held. Your own identity will be kept anonymous, if desired.

We are interested in facts, not literary ability, but please write clearly, completely, and keep your letter within 750 words. We are not looking for "get-rich-quick" stories or freak adventures, and authors must be prepared to substantiate the truth of the statements. Manuscripts submitted and printed become the property of this magazine, and we are not responsible for the return of rejected stories unless sufficient postage is provided for this purpose. Address your contribution to Success Story Department, POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York, N. Y.

"FOCUSED THEORETICAL EDUCATION"

In my case, correspondence home study finished my formal education rather than began it. By means of it, I was enabled to turn my elaborate, wholly impractical education to practical account in a world that I soon found coldly puts a monetary value on things you can *do* rather than things you merely *know*.

I took my A.B. degree from _____ College in 1924. Having a talent for writing and vague literary aspirations, I majored in English. Asked what I expected to do when graduated, I hoped to support myself in some "congenial" literary job such as all young aspirants yearn over—bookshop jobs, cub journalism, proof-reading, "something on a magazine," and working meantime, of course on the "great American novel." At one or another of these I did labor for two years. Then disaster struck; I had a serious breakdown, and simultaneously decided that I would never amount to anything, really, in a literary way.

When able to resume any work at all, I got a job in the _____ Bank, _____, Mass., mostly because the hours were short, the work mechanical and easy. Yet

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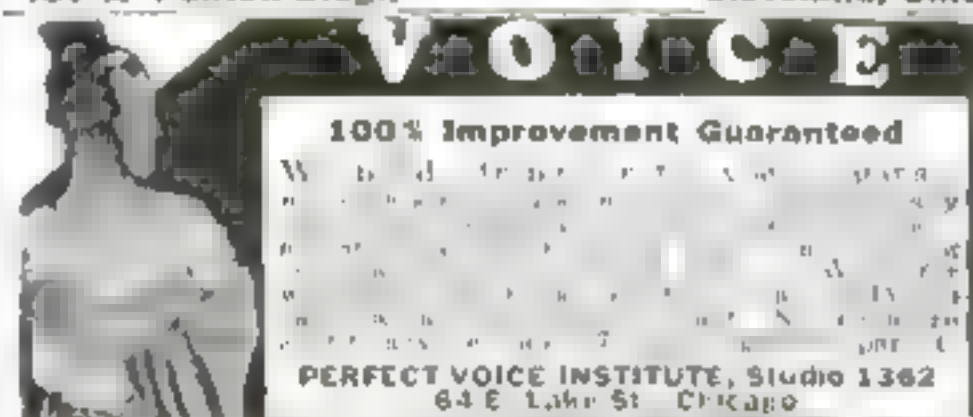
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Secrets of Success

the opportunity that came out of the seemingly dead-end job opened the door to what has since become my life work. My health returned slowly but steadily during the two years I worked there. And secondly, I discovered a hitherto unsuspected flair for business. Lastly, I found my literary talents were not to be utterly wasted for a new field of usefulness opened to me. I had submitted some advertising and publicity ideas to my boss and he gave me every encouragement to try them out.

One day I noticed a window display the ——— Schools had made in a local store. I investigated, then signed up for their course in advertising. This was the best investment I ever made. The course was superb; I can never say too much for it, nor for the wonderful spirit of the teachers behind it. No college course I ever took was better organized, so fascinatingly presented, so thorough, so practical. I studied nights and within eight months had obtained a job as a copy writer in the ——— advertising agency, Boston.

But meantime, realizing I would never get far in the business world without some stenography, I had also taken the ——— course in speedwriting and touch typewriting (my expensive education never having included anything as practical as this). In two months I gained sufficient skill, along with studying the advertising course, to hold down the agency job, acting in frequent secretarial capacity to three men in my office, besides writing copy for many nationally-advertised accounts.

Eventually, marriage cut short this promising career, or rather, interrupted it for several years. Then the depression wiped out my husband's job and our bank account. Our need was imperative, but because of our small son I could not leave home to seek work. I got out my advertising lessons, brushed up (one vast advantage home study courses have over class-room education being that you can keep all your lessons in *tangible* form), and again took stock of myself.

I reasoned that if I could *learn a profession by mail*, I could also *learn to commercialize it by mail*. I took a last plunge and bought a home study course on mail order selling and through it developed connections by mail with small mail-order dealers and firms for whom I now have all the work I can do, writing booklets, folders, and other forms of mail-order advertising on which I specialize. I keep my prices reasonable, turn out absolutely first-class work, and never refuse a client. On these principles I am building a business I wouldn't swap for any job in the world. In slow seasons, I do sales letters for local firms.

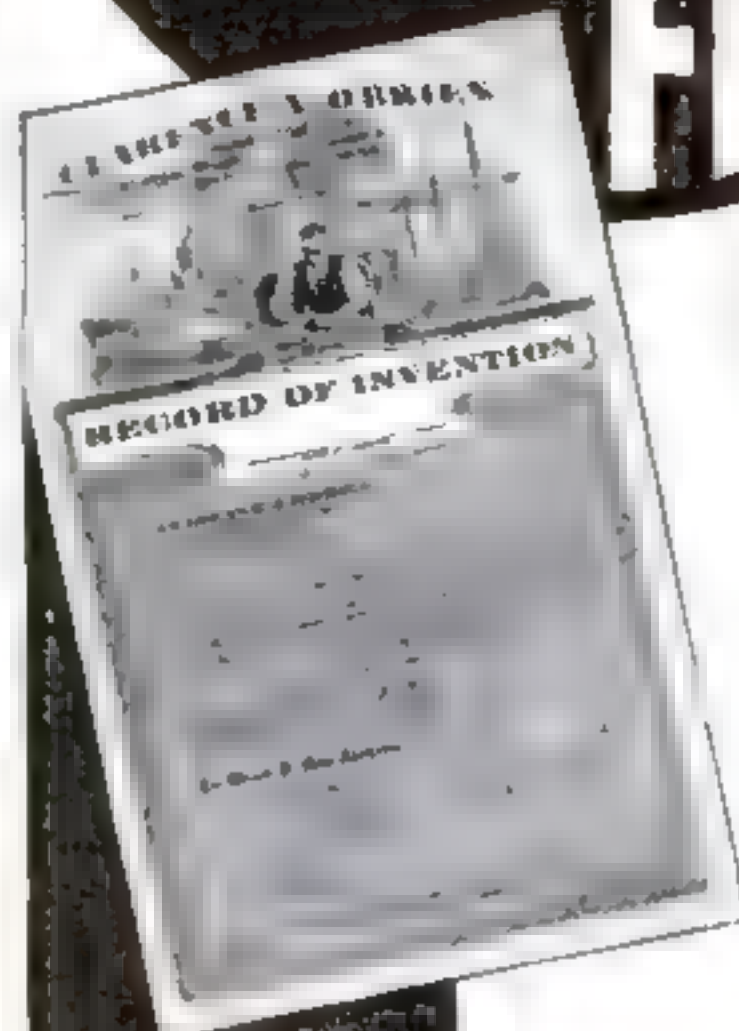
Altogether, I have home study courses to thank for; (1) focusing my theoretical education into practical saleability, (2) discovering to me my *real* talent, (3) winning me my first real job, (4) helping me create a job for myself when there were no jobs, (5) keeping my family together when there seemed no hope, and (6) destroying forever any fear of the future because of "conditions."

—A. R. P., Rutland, Vt.

INVENTORS

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Secrets of Success

WOULD NEVER HAVE PROGRESSED WITHOUT IT

It was at the end of my freshman year at ——— College that I enlisted in the army in 1917. After two years in the service, I returned to my home town, disabled. The Red Cross office told me I was entitled to a college course and I entered ——— University about the same time my claim was presented to the Veterans Bureau in Washington.

It was not until half of the second semester was completed that I received word that I was not entitled to the college training but was entitled to take any correspondence course that I chose. Not being able financially to continue at college, I selected a municipal engineering course with the ——— Schools.

While attending college, I was taking a co-operative engineering course. I would work two weeks for the city as a draftsman, then spend two weeks in school, alternating every two weeks. When I found that I could no longer pursue my college work, I asked for permission to work steadily for the city, which was granted, and began my correspondence course, working at night. Being in the engineering office with several college graduates, I obtained much helpful advice in my lessons and made good progress with them.

After completing about half of the course I found that my duties at the office were becoming easier and that I was able to take on much more difficult work. Gradually, I was assigned to designing storm sewers and sanitary sewer systems, including the computation of velocities, sizes and precipitation. At the end of seven years with the city, I was rated a designer.

In February 1928, I was offered a position with the ——— Terminal Company as a draftsman which I accepted. The salary offered was a big boost over my salary with the city and my first work was making track layouts and various maps of real estate lay-outs. At the end of the first year there was a call for a sewer designer and as I was the only one in the organization who had had considerable experience in that work I was chosen for the job. (Incidentally, it meant \$50 more a month in the old check book).

For two years I designed and re-designed the sewer, water and air systems of the vast yards of the company which was spending \$42,000,000 for the complete terminal. When construction work got under way, I was assigned to supervise and inspect the laying of various mains and laterals. It was wonderful experience because it gave me first hand information as to the correct methods to use in the field. Besides I saw the actual installation of the work that I had previously drawn on the plans. I got a real kick out of that! Certainly it was nice to know that I had had a part in the construction of the finest terminal in the world.

My work with the terminal company ended in April 1933 when the terminal was officially opened to traffic. The country was in the midst of a depression and for a year I was unemployed. In Jan-

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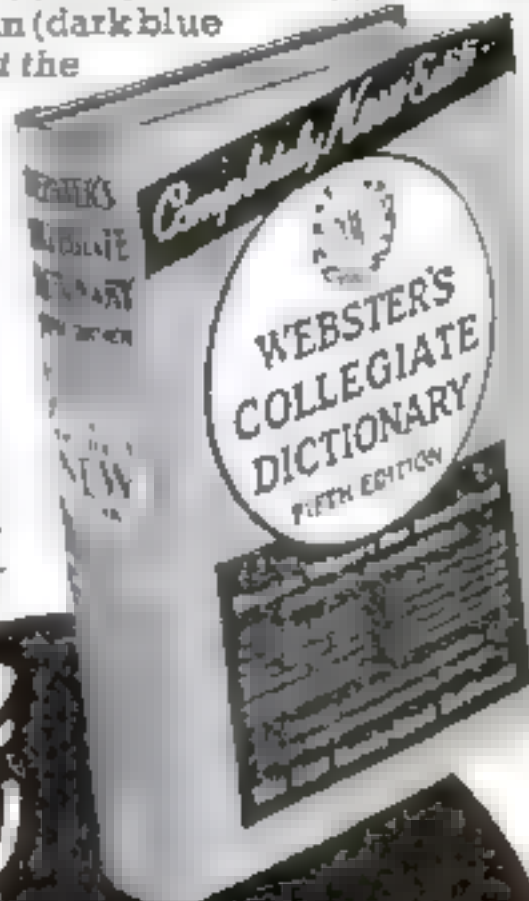
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Secrets of Success

uary 1934, however, I got a job with the CWA as a sewer designer, working at the City Hall in ——. In the Spring of that year, the City of — held a competitive Civil Service examination for draftsman in the sewer department. I took it and was rated first. The appointment came a few weeks later and I began my duties in that department. The salary was about half that paid by the terminal company but it was no time to quibble.

In August 1935, I saw a notice that the Federal Government was offering jobs to engineers to work as resident engineer inspectors on PWA work. I sent in my application and was appointed in December. Since that time I have been employed by the PWA at a good salary.

With only two years of college, I realize that I would never have progressed as I have without the help of home study. It has meant much to me.

—H. B. W., Akron, Ohio

HOSPITALS COULDN'T HOLD HIM BACK

When I was in the sixth grade of a local school, I had the misfortune to break one of my legs. The bone failed to knit and I was unable to attend school. With the aid of a tutor I was able to complete, over a period of time, the necessary required work for admission to the freshman class of high school.

In the meanwhile my leg had become sufficiently strong to enable me, with the aid of crutches, to attend high school but after only six short weeks I again had a fall which disabled both legs through fractures.

Faced with the necessity of continuing my high school education out of the class room another tutor was called in, but this did not prove satisfactory. The expense was too great and the fact that I was in various hospitals in several different states made progress very slow.

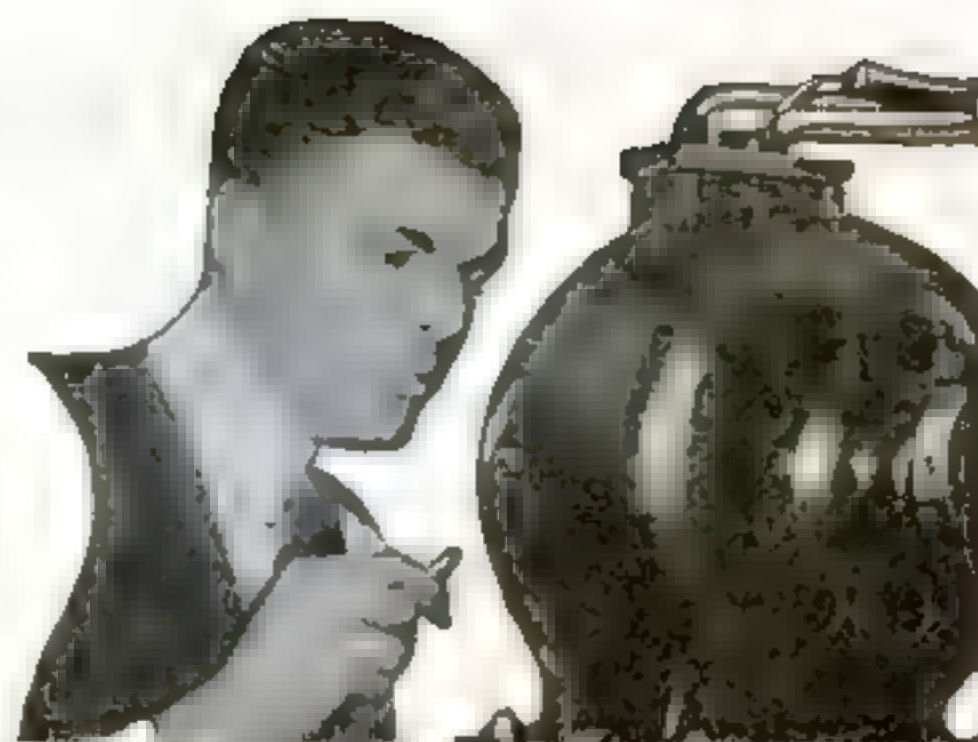
It was at this time that I became interested in correspondence study and enrolled for several courses with the Extension Division of — University. These courses were acceptable to the high school as credits toward a graduation certificate, so I continued them until now I have to complete but one course to be graduated from the school.

During this period I have completed courses in English, mathematics, science, economics, history, etc. Most of this work has been done while lying in a hospital bed under conditions which would have made obtaining an education in any other way impossible. I was able to work when I felt equal to it and as fast or slowly as I desired.

If I am not able to attend the university and further hospitalization is necessary, I will be able to continue my education by means of the extension division, as many as one-half of the university credits being attainable by the correspondent student.

Without the aid of correspondence study, I should hate to think of the disadvantages which I would have to overcome when and if my legs ever become strong enough to be of use to me in making a living.

—C. S., Madison, Wis.



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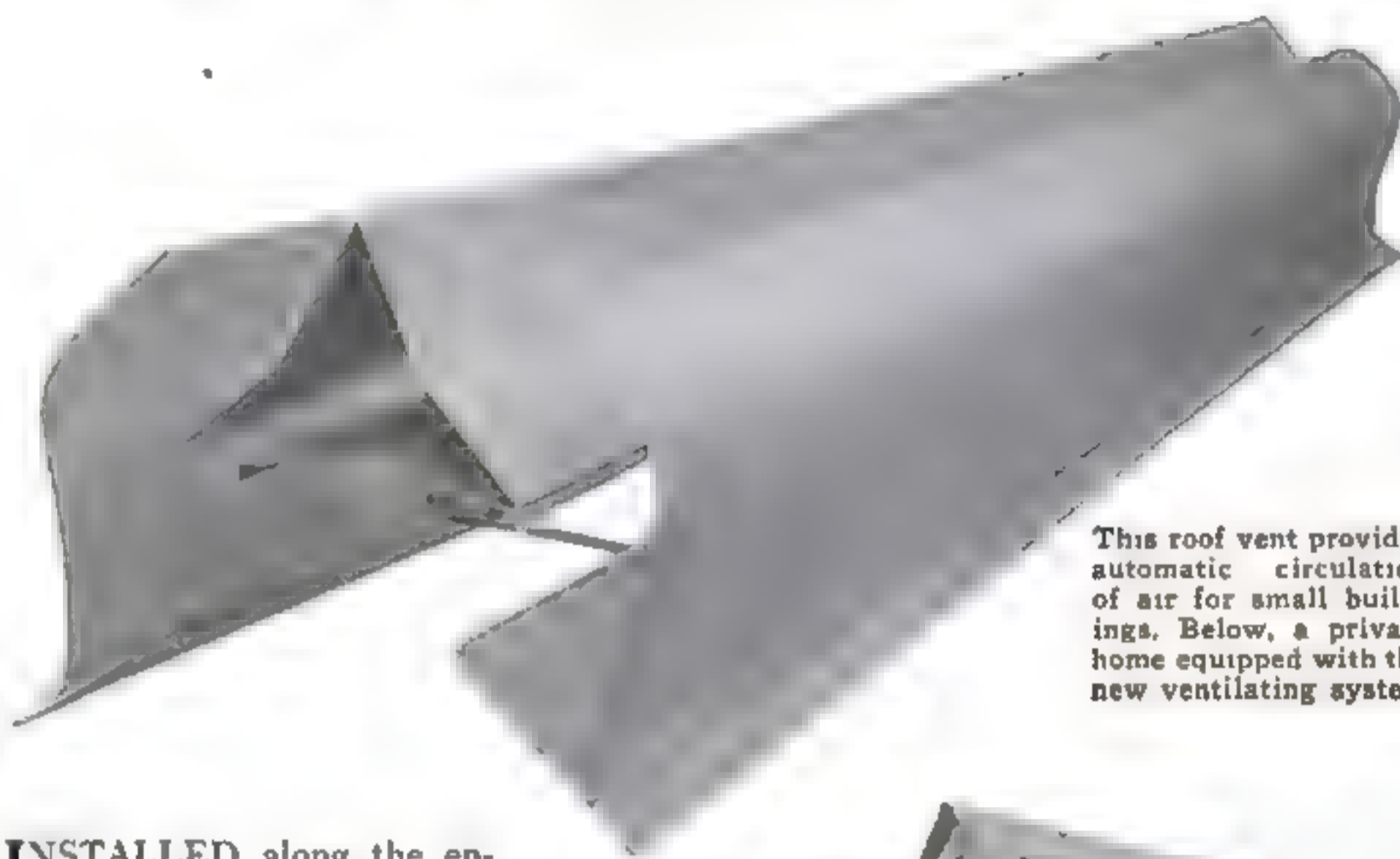
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New Ideas FOR HOME OWNERS



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INSTALLED along the entire length of the roof ridge of a house, a new storm-proof vent provides an efficient and inconspicuous method of ventilation. Made of sheet metal and designed for application to existing buildings as well as those under construction, the device serves as a valve, allowing the warm inside air to escape and the fresher outside air to enter. Due to the fact that warm air rises and colder air tends to descend, the valve produces a continuous circulation of air, drawing fresh air in at the lower levels and exhausting the old air at the highest point in the structure. Being automatic, the system requires no mechanical blowers. When not in use, the valve can be closed by means of a damper. Provision

also is made for drainage, so that it is possible to leave the ventilator open during rain storms without having water enter the building.

Because of its pointed shape, the vent forms a natural ridge, blending into the general contour of the roof.

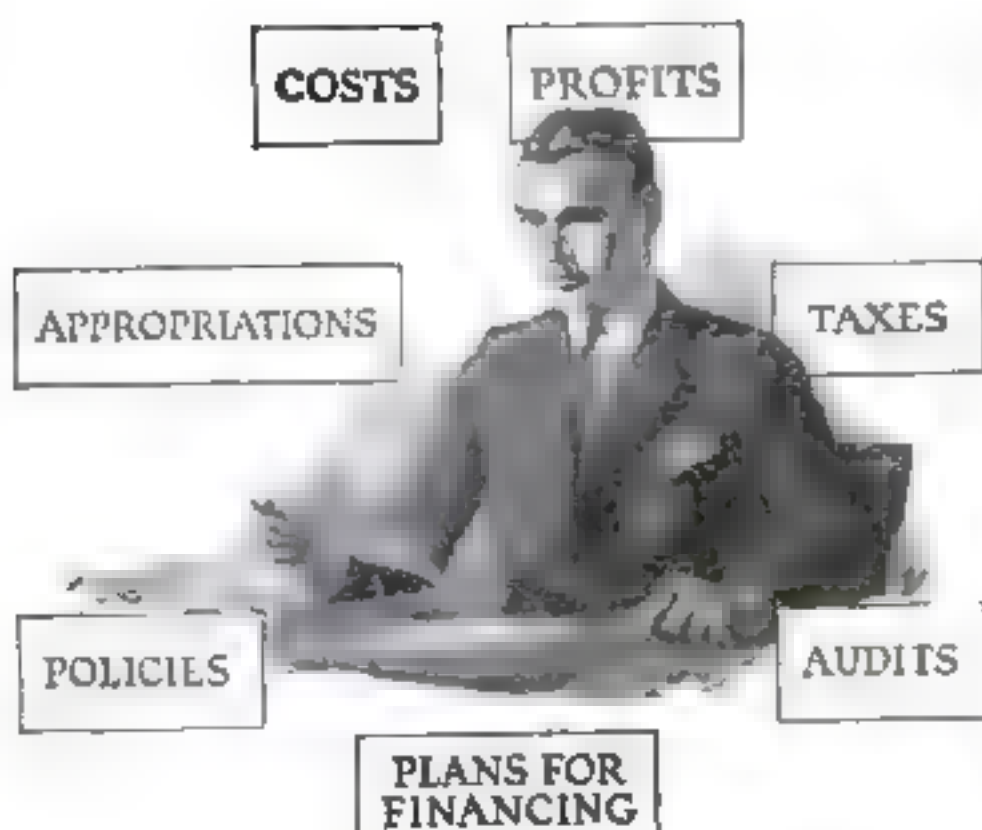
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Easily applied to a plaster wall with nails and cement, this new wall board is surfaced with a veneer of beautifully grained wood, as shown at right





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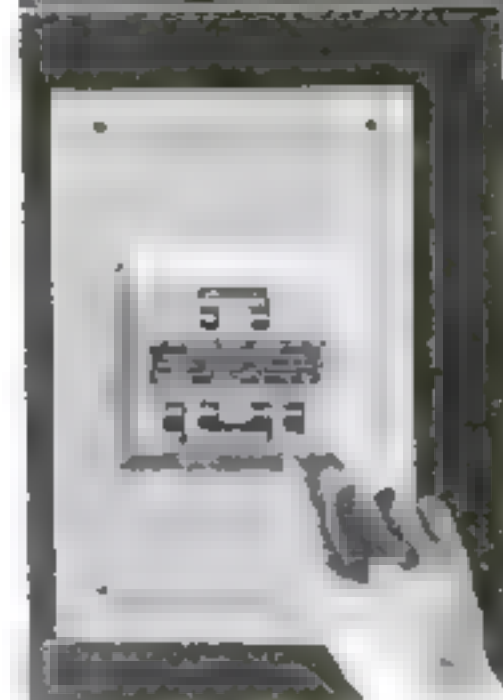
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CIRCUIT BREAKER TAKES PLACE OF FUSE BOX

FUSES no longer are a necessity in home electric circuits that are equipped with a new protective device just marketed. Housed in a molded, sealed cabinet, the apparatus is connected to the main electric feed line. When a short circuit occurs, a thermostatic strip heats up and expands, opening a silver-tipped contact bar which shuts off the current flow. After



The contact mechanism of the circuit breaker. The pencil points to the common central contact

When a short circuit breaks the contact, it can be restored by moving a lever after the short circuit is eliminated

the "short" has been located and fixed, the device is reset by moving a lever to the "on" position. Unlike a fuse box, the circuit breaker requires no replacement parts.

Questions FROM HOME OWNERS

Q.—AN UPHOLSTERED chair stored in my cellar has developed mildew. Is there any way that this can be removed?
G.T.N., Milwaukee, Wis.

A.—BRUSH the fabric thoroughly to remove the excess mildew and then sponge the chair with a soap solution containing a small amount of ammonia.

Cleaning Oil-Stained Concrete

G.R.A., DENVER, COLO. Although there is no completely satisfactory method of removing oil stains from a concrete floor, they may be partly removed by soaking the stained area with gasoline and then mopping it up with blotting paper or some other porous material. This should be done several times for best results.

Loose Pipes Cause Rumble

V.D.L., LITTLE ROCK, ARK. Loose hanging pipes may cause a rumbling or a rattling noise when faucets are turned on or off, due to vibration of the pipes when the water flow is (Continued on page 18)



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QUESTIONS FROM HOME OWNERS
(Continued from page 17)

started or stopped. This condition is easily remedied by supporting and fastening the pipes securely to prevent any possibility of sagging.

Heater Thaws Frozen Pipes

N.L., TERRE HAUTE, IND. A small electric reflector heater is a safe and excellent substitute for a blowtorch when applying heat for the purpose of thawing out a frozen pipe.

Papering Over Cracks

Q.—IS IT possible to apply wall paper over a long crack in a wall? The plaster is merely cracked, not loose.

A.—CRACKS such as described are due to settling of the house, and may show through again if merely patched with plaster. In addition to patching, the entire panel of the wall can be covered with a special lining cloth over which the wall paper may be applied. This keeps the crack from spreading and showing through.

Low-Cost Covering for Pipes

M.W., DULUTH, MINN. A cheap and effective covering which will keep pipes from freezing can be made by wrapping the pipes with old cloth, then with layers of newspaper, and finally with strips of burlap. This covering should be made from four to five inches thick to provide adequate protection.

Food Stains on Table

L.R.B., WHEELING, W. VA. Food stains can be removed from polished woodwork by washing. Obtain some "green soap" from the drug store and put a teaspoonful or so on a cloth dampened with warm water. Run this over the surface until you get circles of froth. Wipe off the lather with another rag moistened with lukewarm water, and, finally, rub with a clean, soft, dry cloth, used with the grain of the wood. Pure white soap can also be used.

Water-Tight Doors

Q.—DURING heavy rainstorms, water often leaks in under the bottom of our front door. What is the best way to prevent this?—R.G.S., Frankfort, Ky.

A.—WEATHER stripping obtainable in any hardware store applied to the door should check leaking, or you might install a new leakproof threshold plate just placed on the market. This unit fits any door and has self-draining features that make it completely water-tight.

Rock Salt Kills Weeds

Q.—THIS SPRING we plan to fix up an old tennis court now overgrown with grass and weeds. How can we kill this vegetation?—D.C., Roanoke, Va.

A.—A SATURATED solution of rock salt in water will check the weed growth. It works best if it is applied in the early spring.

PLANETS' ATMOSPHERES EXPLAIN THEIR COLORS

WHERE do the planets get their colors? Recent studies of their atmospheres, according to Dr. Henry Norris Russell, Princeton University astronomer, have finally explained the hues of the most conspicuously tinted members of the solar system—Mars, Uranus, and Neptune.

Mars, the "Red Planet," owes its familiar ruddy hue to oxidized iron that stains its rocks. In the thin Martian atmosphere, ultra-violet rays of sunlight penetrate farther and produce a layer of ozone much nearer the surface than in the case of the earth, where this powerful oxidizing agent is found only in the upper air. Hence rocks containing iron are colored much redder upon Mars than upon the earth.

The striking green color of Uranus and Neptune is less familiar to amateur stargazers, but only because Uranus is barely visible to the naked eye and Neptune can be seen only with a telescope. Until recently it has puzzled astronomers. Now it is known to be due to methane, or marsh gas, which has recently been discovered to make up a large part of the two planets' extremely dense atmospheres. Under such high pressure the gas acts as a light filter and strains out red and orange rays from the sunlight that Uranus and Neptune reflect, leaving their light predominantly green. Laboratory experimenters have lately duplicated the effect on a small scale.

PLANES GIVE SUN BATHS FAR ABOVE THE EARTH

Sun bathers may now take their solar baths thousands of feet above the ground, in airplanes flown by an eastern flying service. The fuselages of several airplanes have been rebuilt with special transparent covering material over the sides and top, permitting sunshine, along with the beneficial ultra-violet rays, to enter. The craft are divided into compartments which insure privacy to nude or seminude sun bathers. It is claimed that at altitudes of 3,000 to 4,000 feet the sun's rays have so much more effectiveness that a ten-minute sun bath above the clouds is equivalent to exposure to sunshine at sea level of one to two hours.

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ELECTRIC EYE GUIDES GIANT TELESCOPE

OPERATING with hair-breadth accuracy, a delicate electrical mechanism developed by two University of Wisconsin scientists automatically keeps an astronomical telescope trained on a star. Heart of the apparatus is an electric eye, which is made to control the telescope-turning mechanism to compensate for the rotation of the earth. Although still in the experimental stage, recent tests of the device on the sixty-inch telescope in the Mount Wilson Observatory in California showed that even when deliberate errors were introduced into the driving mechanism of the telescope, the photo-electric guide corrected them.

The electric-eye mechanism is trained on a star so that starlight strikes a reflecting knife edge and splits into two beams. These are made to shine alternately on the light-sensitive surface of the photo-electric cell. If the telescope is not correctly aimed, the light will not be centered perfectly on the knife edge; thus one of the split beams will be stronger than the other, causing a variation in the flow of current through the cell. This current variation, when amplified, is made to control the electric motor which swings the giant telescope into position.

In some cases, the amount of starlight striking the device is so small that it must be amplified a billion billion (1,000,000,000,000,000,000) times. The guiding apparatus is expected to be especially useful for taking astronomical photographs.

TINY MOVIE CAMERA FILMS VOCAL CORDS

So SMALL and compact that it can be pushed into the larynx, a motion-picture camera invented by two Austrian scientists is expected to be useful in studying the mechanics of the voice. The diagnosis of throat diseases, and the physiology of producing various vowel sounds can also be investigated with its aid. The new camera is the latest of a series of miniature apparatus for photographing internal parts of the body. One camera, for example, takes pictures of the inside of the stomach. It is swallowed by the patient, and carries its own tiny light bulb. Once the picture has been taken, the surgeon pulls up the camera and develops the film.

MAKE MAGGOT SECRETION TO HEAL WOUNDS

THE work of maggots in healing wounds and combating gangrene is being taken over by synthetic chemistry. The tissue-forming substance, allantoin, which is excreted by maggots, has been produced artificially, and is being used to treat various wounds, ulcers, and gangrene. In wars of the past, army surgeons have noticed that wounds infested with maggots, the larvae of the blowfly, healed most promptly, with fewest complications and least pus formation. In 1929, a surgeon developed a method of treating wounds by introducing live maggots, but there were many disadvantages to the use of living larvae. The new preparation is expected to give the same results without the discomforts and disadvantages.

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PREHISTORIC INSECTS HUNTED IN AMBER

Using the panning methods of the Yukon gold rush, two Harvard scientists recently prospected for prehistoric insects buried in amber on the shores of a lake in northern Manitoba, Canada. Millions of years ago, in the age of the dinosaurs, the insects were caught in pitch oozing from the trunks of coniferous trees. This pitch turned to amber and the insects remained buried in the translucent resin. By shoveling material found on the lake shore into a large pan and letting water run through it, the scientists washed away lighter particles and left the lumps of amber remaining on the pan bottom. In this manner, they accumulated nearly 400 pounds of amber. In it they discovered at least one primitive insect, a member of the wasp family, which is unlike anything known before.

SHORT-WAVE RADIO TO LINK TELESCOPES

TO PROVIDE instant communication between the new 200-inch telescope at Mount Palomar, the Mount Wilson Observatory telescope, and the California Institute of Technology, engineers are now installing a three-way radio-telephone system. Operating on the ultra-short-wave bands, the system is to be arranged in such a way that a bell will ring at the observatory being called, eliminating the necessity of having operators always on duty. Besides providing communication facilities for the exchange of information between the observatories, the three radio stations also will be used in extensive tests to determine the effect of humidity and temperature on short-wave-radio transmission.

WORLD SIGN LANGUAGE IS PROPOSED

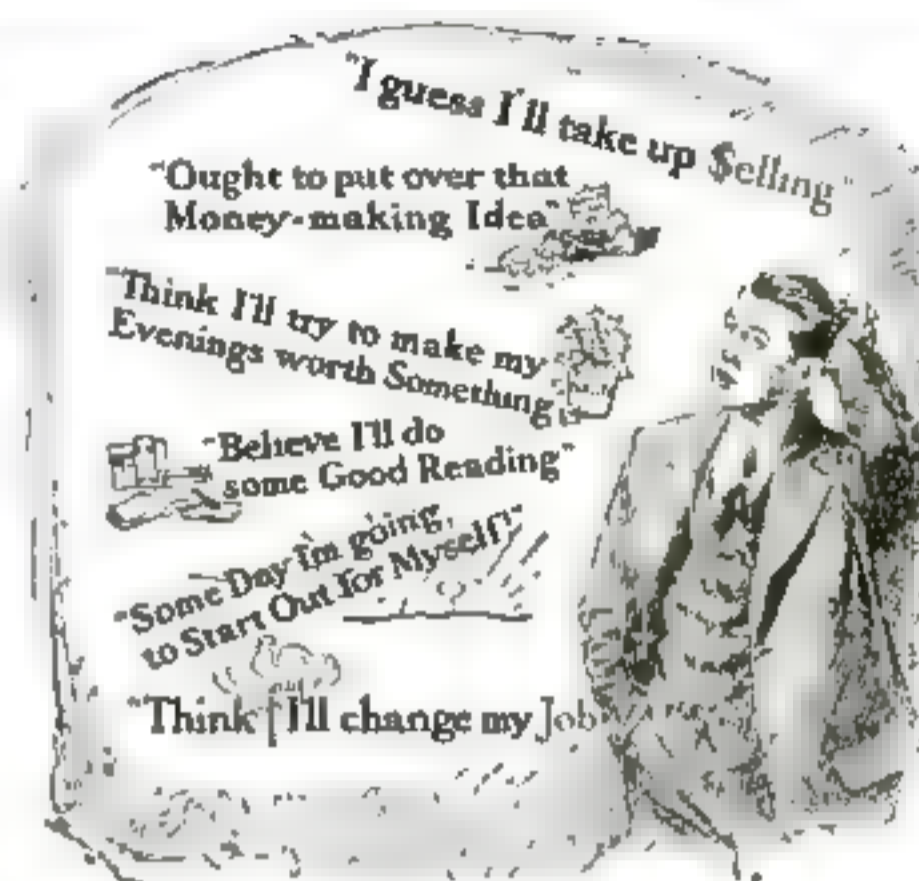
AN INTERNATIONAL sign language, promulgated by movies and television, and controlled by a world commission, was recently proposed by a prominent British scientist. Man, he claims, is not primarily a tool-using animal, but is, rather, a symbol-using creature. Speech was born when separate signs were evolved for separate ideas; the corresponding mouth gestures were combined with the emotional language of grunts, chuckles, and cries, thereby ultimately producing speech. Sign language, he believes, could be logically developed so as to express the most abstract thoughts of man.

AFRICAN NATIVES MAKE CLOTHING FROM BARK

NATIVES of Northern Rhodesia, Africa, wear clothing made from the inner bark of trees. Stripped from a tree and soaked in water, the white bark turns a reddish brown color and is soft and pulpy. It is tapped gently with a blunt instrument and then twisted like taffy to stretch it to four times its original area. After an oil bath, the bark is dried in the sun and worn as a cloak. The bark cloth is said to be as soft as a fluffy wool blanket, and to be exceptionally strong and durable.



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The best kits for beginners are given in the accompanying list under the headings "Model-of-the-Month Kits" and "Simplified Ship Model Kits." For those who wish to build larger and more ambitious models, there are our standard ship model kits.

An example of the sort of model that can be constructed from one of the standard kits is illustrated above. It is the *Swallow*, a two-masted Baltimore clipper used as a privateer in the War of 1812. Although it is a true scale model in every sense of the word, it is relatively small—20 in. long and 13 1/4 in. high over all. It is so graceful in design, so perfect in all details, that the most experienced model makers will find it an appealing project, yet it is not too complicated for craftsmen of limited experience. The construction kit contains the four hull pieces or "lifts" sawed to shape and all the necessary raw materials, together with three sheets of blueprints and instructions.

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- L. Farragut's flagship *Hartford*, steam-and-sail sloop-of-war, 33 1/2-in. hull. 8.45*

(Continued on page 23)



KIT 2M—Ocean freighter, 14 in. long

KIT Q
This is the privateer *Swallow*, a model with 12 1/2-in. hull

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OUR CONSTRUCTION KITS

(Continued from page 22)



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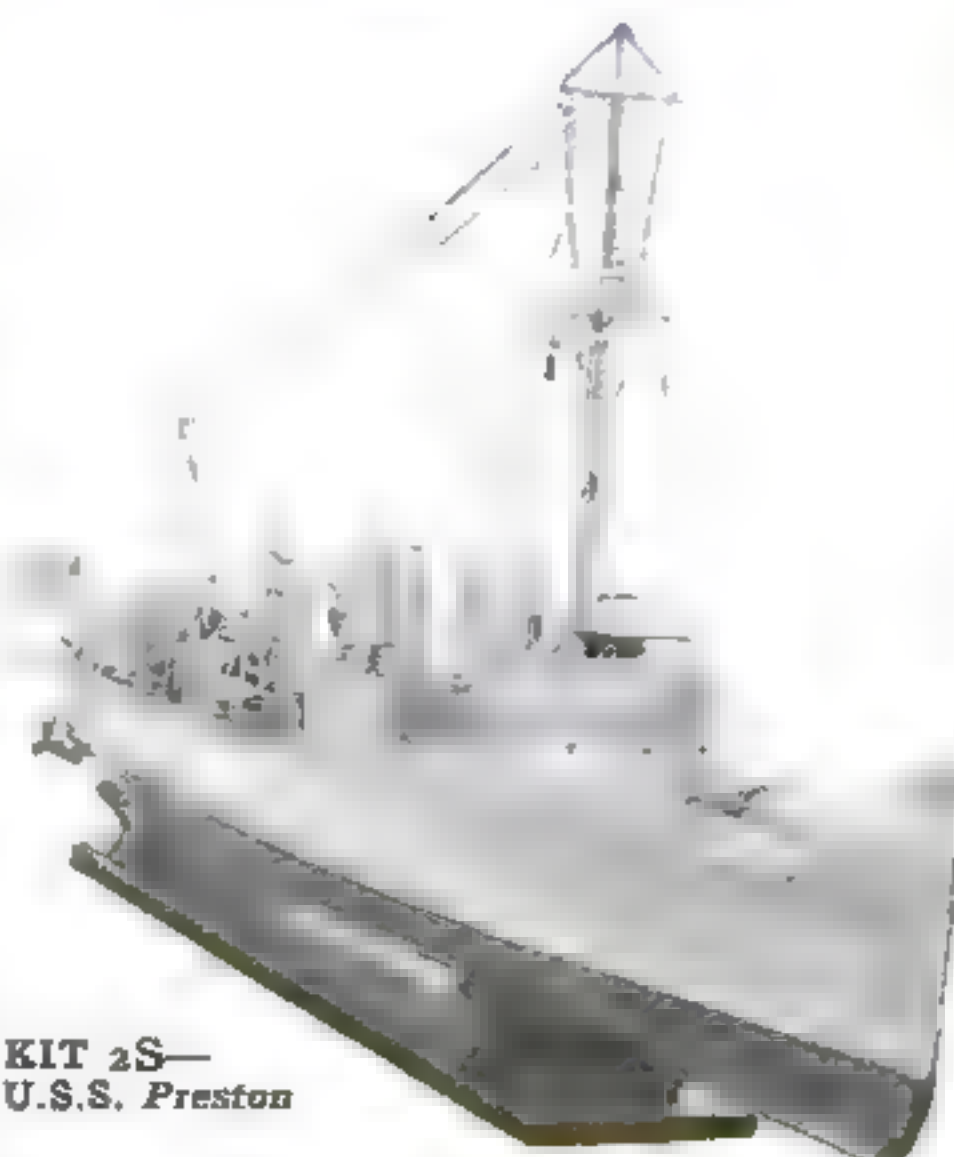
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(Continued on page 23)



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(Continued from page 23)

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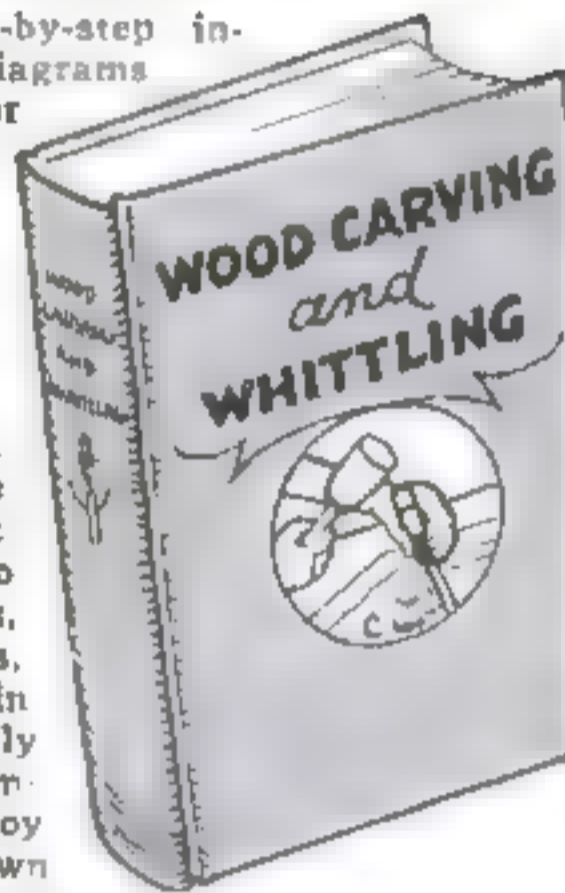
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BOTTLED PAPAYA JUICE TO MAKE STEAKS TENDER

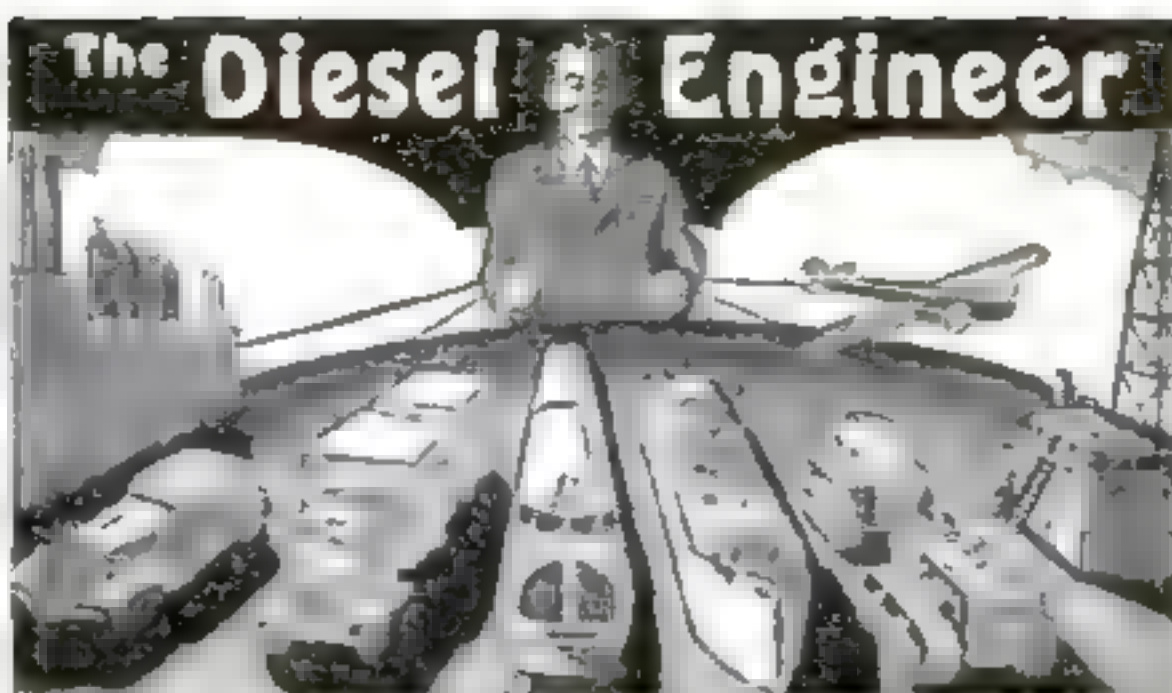
MAKING tough meats palatable by chemical means may become a common practice in American kitchens if plans of a firm in Cincinnati, Ohio, are successful. The juice of the papaya tree has long been used by South Sea islanders to make meat more digestible before cooking, although they were unaware of the action involved. The juice contains a substance, known as papain, that is the vegetable equivalent of pepsin, and has the power to digest proteins. This substance has been known as a standard ingredient to pharmacists, and has been used in preparing indigestion remedies for many years. The Ohio firm plans to distribute the juice in bottles of convenient size for use by housewives in preparing tough cuts of meat. The papaya tree has been cultivated in Florida and California for some time for the sake of its fruit, which is being sold even in northern markets. The fruit is sometimes called the pawpaw, although it does not resemble, and is not related to, the native American plant of that name.

BALLOONS FIND VAPOR IN THE STRATOSPHERE

AIR samples obtained miles above the earth by crewless and manned balloons are giving science a new picture of the stratosphere, according to Prof. Auguste Piccard, its pioneer explorer. Formerly this cloudless upper level of the atmosphere was supposed to be free of moisture. Recent analyses of its air, however, reveal ten times the amount of water vapor that would be sufficient to cause rain at lower altitudes. Evidently the only reason that clouds do not form and rain does not fall is the lack of dust or other particles on which the moisture can condense. Any terrestrial material supplies such particles in abundance, which accounts for the rains that occur when great volcanic eruptions shoot billows of dust into the stratosphere. It also explains the small patches of fog, a few yards in diameter, that stratosphere balloonists have been surprised to see floating in the vicinity of their gondolas, and which hung about the American balloon *Explorer II* in such smokelike clouds that the crew feared the ballast bags were on fire. The unexpected humidity of the upper air levels, Prof. Piccard suggests, probably will have to be taken into consideration by those who are making plans for future air lines through the stratosphere.

MIDGET LIFTING MAGNET HAS GIANT STRENGTH

ONE of the most powerful magnets ever built was tested recently at the Massachusetts Institute of Technology. Although less than nine inches in diameter, it has a power twice that of most of the giant magnets now used in the laboratories of the world. The strength of a magnetic field is measured in "gauss," and the new magnet has a gaussage of 120,000, whereas the earth's magnetic field in the vicinity of Washington, D. C., has a horizontal magnetic strength of only .1802 gauss.



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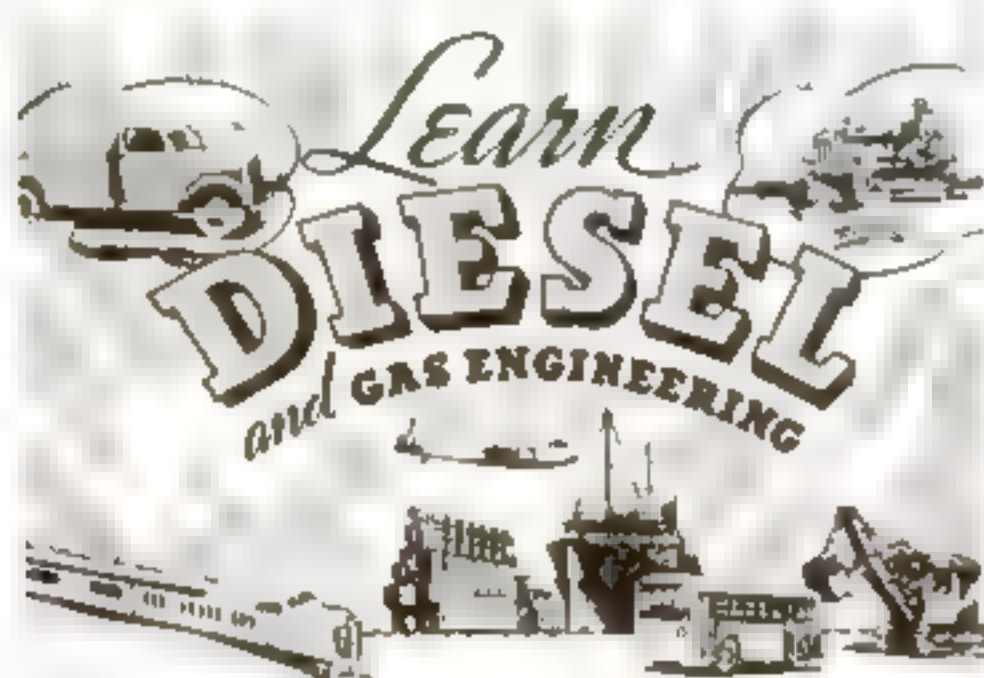
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SHIP FOR COMPASS TEST WILL BE NON-MAGNETIC

PLANS for a "non-magnetic" ship, second of its kind ever to be built, have just been announced by the British Admiralty. Designed for world-wide observations of the behavior of compasses at sea, the vessel will be practically devoid of iron, steel, and other magnetic materials that might affect its sensitive scientific instruments and throw them in error.

Because of mysterious periodic changes in the earth's magnetic field, the reading of a compass at any given point on the globe shifts slightly from year to year. Hence up-to-date magnetic observations are of urgent importance in preparing navigation charts to guide the world's vessels. For two decades the American non-magnetic yacht *Carnegie*, of the Carnegie Institution, cruised the seas collecting this information, until it was destroyed by an explosion at Samoa in 1929. The British vessel will carry on its work.

"R. R. S. Research" is the name chosen for the new craft, the initials standing for "royal research ship." Like the *Carnegie*, it will be a sailing vessel with an auxiliary power plant. Its 650-ton displacement will make it a little larger than its predecessor, and its construction will make greater use of bronze and other non-magnetic metals and alloys in preference to wood.

GAS PRESSURE DUMPS AIRPLANE'S FUEL

DUMPING the fuel from the tank of a disabled airplane that is about to make a forced landing is accomplished by carbon dioxide in a new device. Planes equipped with the system would carry a cylinder of carbon dioxide, or other non-inflammable gas under pressure. A valve, operated by the pilot, shuts off the supply of fuel to the carburetor, and, at the same time, releases the carbon dioxide into the gasoline tank. The fuel is thereby forced out and dumped into space, and the dangerous gasoline vapors in the tank are displaced by the inert gas under pressure.

CHEMICALS FREE OIL IN "DRIED-UP" WELLS

A NEW process, patented by a St. Louis, Mo., inventor, is said to make "dried-up" wells produce oil. Such simple chemicals as hydrochloric acid and sodium fluoride, properly emulsified and injected into the well, are the basis of the invention. It is explained that many oil wells which stop producing are not really dry in the sense that their supply is exhausted. In many cases, the output of oil is stopped only by the building up of solid deposits of inorganic salts or wax, which clog the channels or pores of the oil-bearing rock. The chemical mixture has the property of dissolving such deposits, and, it is claimed, will make the rock more porous than it was originally, by eating out new openings. The composition is inactive until it reaches the clogging minerals deep down in the well, and therefore does not attack the casing and other parts of the oil-well machinery.

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TESTS SHOW "WINDBURN" TO BE ONLY A MYTH

Is THERE such a thing as "windburn," as distinguished from sunburn? That it doesn't exist, except in popular imagination, is the joint conclusion of an American and a British experimenter. One of them wrapped his forearm with a piece of rubber, cut from an inner tube and provided with an aperture of one square inch to expose a section of bare skin. Then he held the arm in the forty-mile-an-hour blast of a wind tunnel for half an hour. The exposed skin showed "goose flesh," but no signs of the reddening or chapping that most people believe the wind can cause.

In another test, however, one of the men placed a drop of perspiration on a transparent sheet of quartz and exposed his arm beneath it to the rays of a powerful mercury-vapor sun lamp. His skin soon became uniformly sunburned, except for a small spot beneath the perspiration drop, where the skin was noticeably less reddened.

From these tests the experimenters conclude that a normal film of perspiration acts as a partial shield against the sun's ultra-violet rays, which cause sunburn. In a strong wind, the protective film evaporates. This explains the supposed phenomenon of "windburn," the experimenters suggest, as simply a case of sunburn which has been made more severe because the wind has evaporated the protective coating of perspiration.

CATTLE CHOOSE FOOD IN ODD "CALFATERIA"

A CURIOUS "calfateria" is a feature of the U. S. Department of Agriculture Experiment Station at Belle Glade, Fla. Fourteen different kinds of grass have been planted in strips across a fenced-in field. At certain hours of the day, cows and calves are turned into the field while observers with watches and record sheets note down the strips they go to. The scientists are, in effect, letting the animals vote on the kind of grass they want. In some instances, the animals will pass over half a dozen strips before they begin to graze. Some of the grasses they seem to prefer are pra grass, Guinea grass, and centipede grass. A type of grass which is, at present, widely grown as a pasture crop in the northwestern part of the country, canary grass, seems to be desired least of all by the "calfateria" patrons.

BASES FOR FALSE TEETH ARE MADE OF GLASS

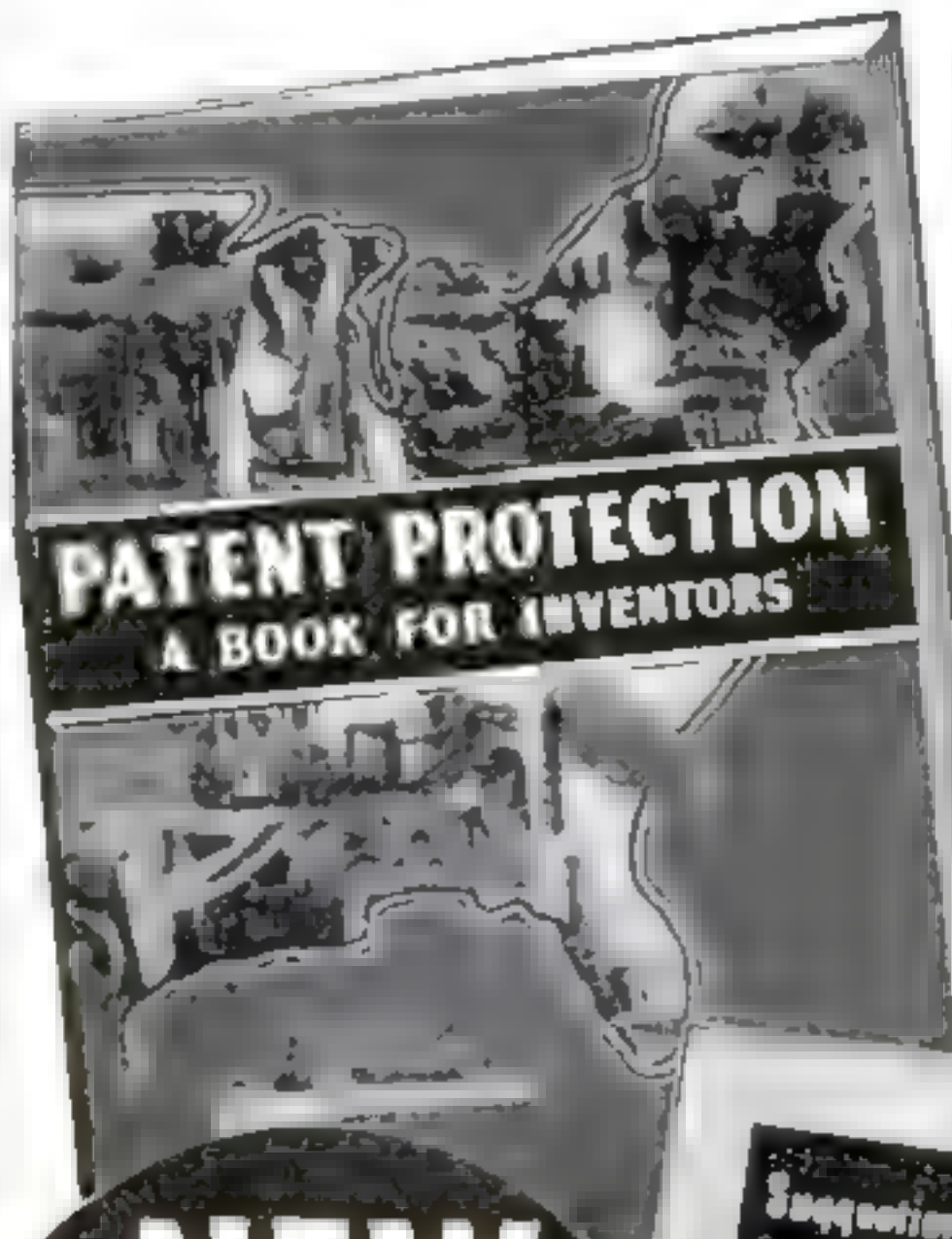
GLASS is being used as a base for false teeth by a Toronto, Canada, dentist. Recently he reported considerable success with the innovation to the American Dental Association. The glass can be colored to match exactly the gum tissue of the individual patients, it will withstand considerable pressure, and if it is broken by dropping the false teeth on the floor, it can be repaired easily. The experimenter now is attempting to eliminate all remaining chances of breakage by experiments in treating the glass to make it shatterproof.

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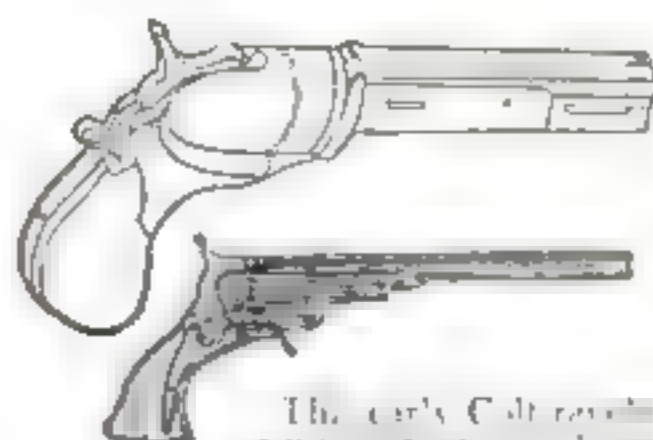


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RUSH THIS COUPON TO

Here are the most dependable brakes ever built- **PERFECTED HYDRAULIC BRAKES**

(WITH DOUBLE-ARTICULATED BRAKE SHOE LINKAGE)

.. and it was Chevrolet that perfected them !



Pressure tested tubing and heavily armored piping transmit braking pressure from the master cylinder to the four main cylinders, which exert their pressure to expand the two brake shoes.

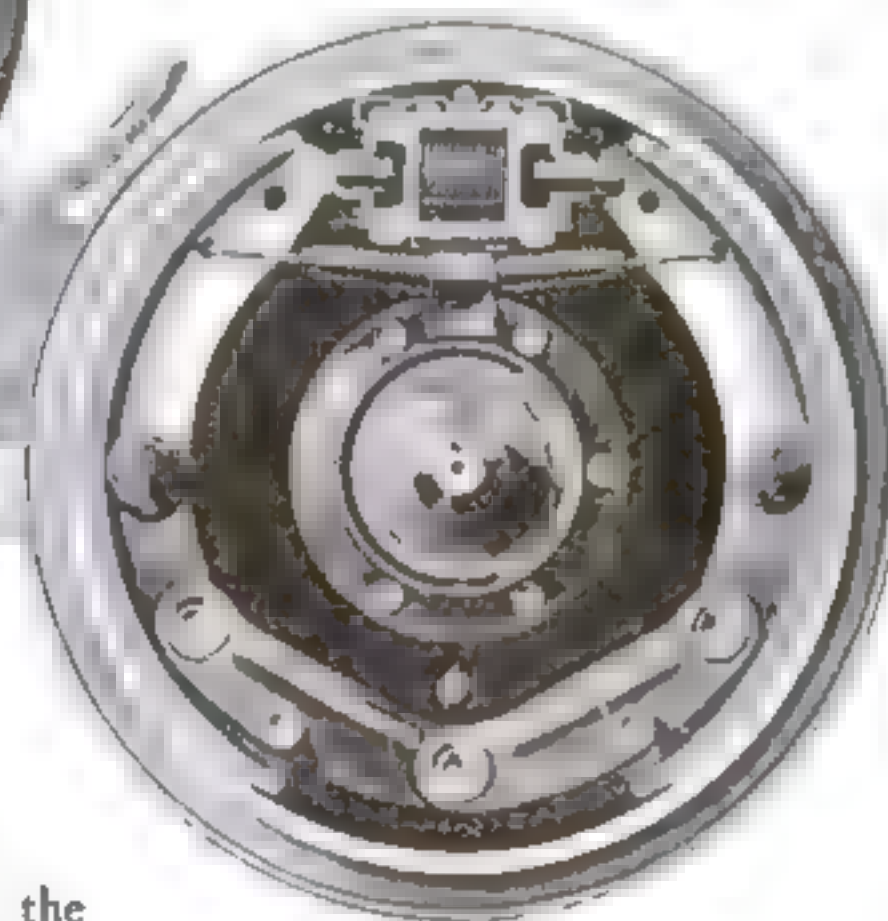


Of all the braking systems ever developed for motor cars, the soundest and most dependable is the Hydraulic braking system; and of all Hydraulic brakes, the most thoroughly efficient are Perfected Hydraulic Brakes—built by Chevrolet!

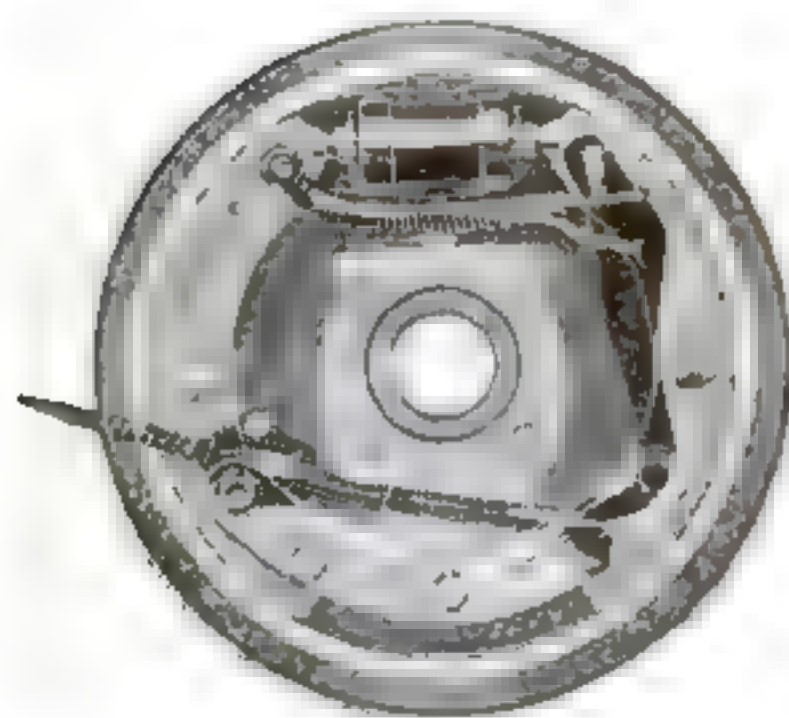
These brakes have been built into the chassis of more than 1,300,000 Chevrolet cars to date. They are hailed by owners and engineers alike as the greatest safety factor in modern motoring. They are absolutely positive in action. They are velvety smooth. They give the highest degree of quick, straight-line stops under the lightest pedal pressure—braking that is instantly effective, braking that is always under exact control.

Your Chevrolet dealer will be glad to demonstrate these brakes, as well as Chevrolet's New Valve-in-Head Engine, Improved Knee-Action Ride*, New All-Silent, All-Steel Body, and many other features found only in this one low-priced car—the *complete car, completely new.*

CHEVROLET MOTOR DIVISION
General Motors Sales Corporation
DETROIT, MICH.



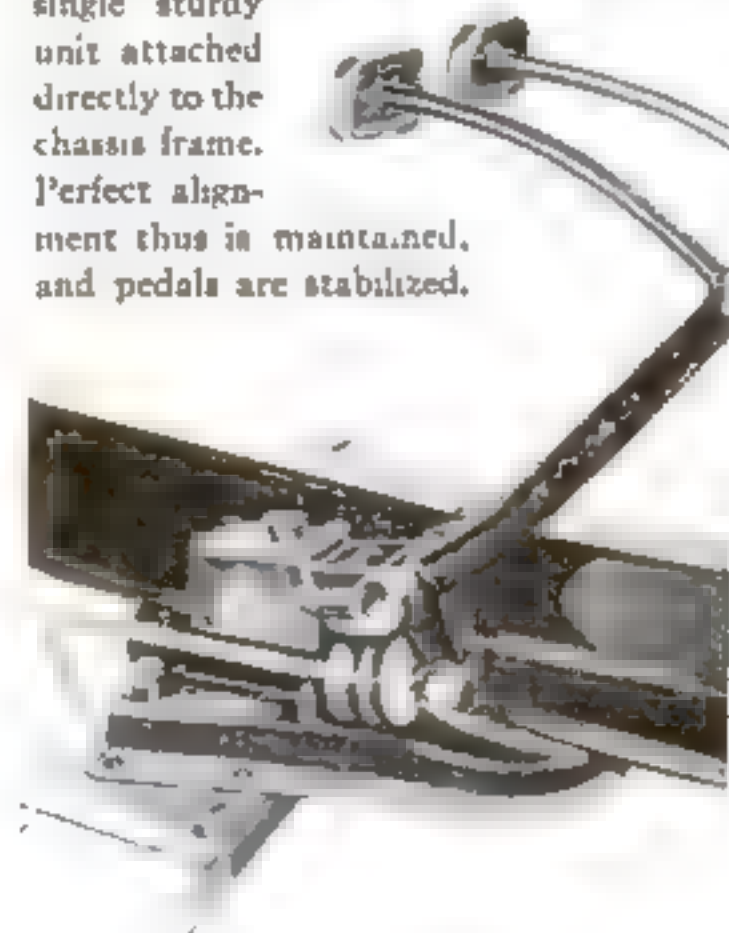
Chevrolet's exclusive double-articulated brake shoe linkage assures a full contact of the brake lining with the drums, and compensates for the gradual wear on the lining.



The hand-operated emergency brake, connected by flexible cables, operates both brake shoes in each rear wheel, as shown above.

**Knee-Action and Shockproof Steering on Master De Luxe models only. General Motors Installment Plan—monthly payments to suit your purse.*

The hydraulic brake master cylinder and the clutch and brake pedal bracket form a single sturdy unit attached directly to the chassis frame. Perfect alignment thus is maintained, and pedals are stabilized.

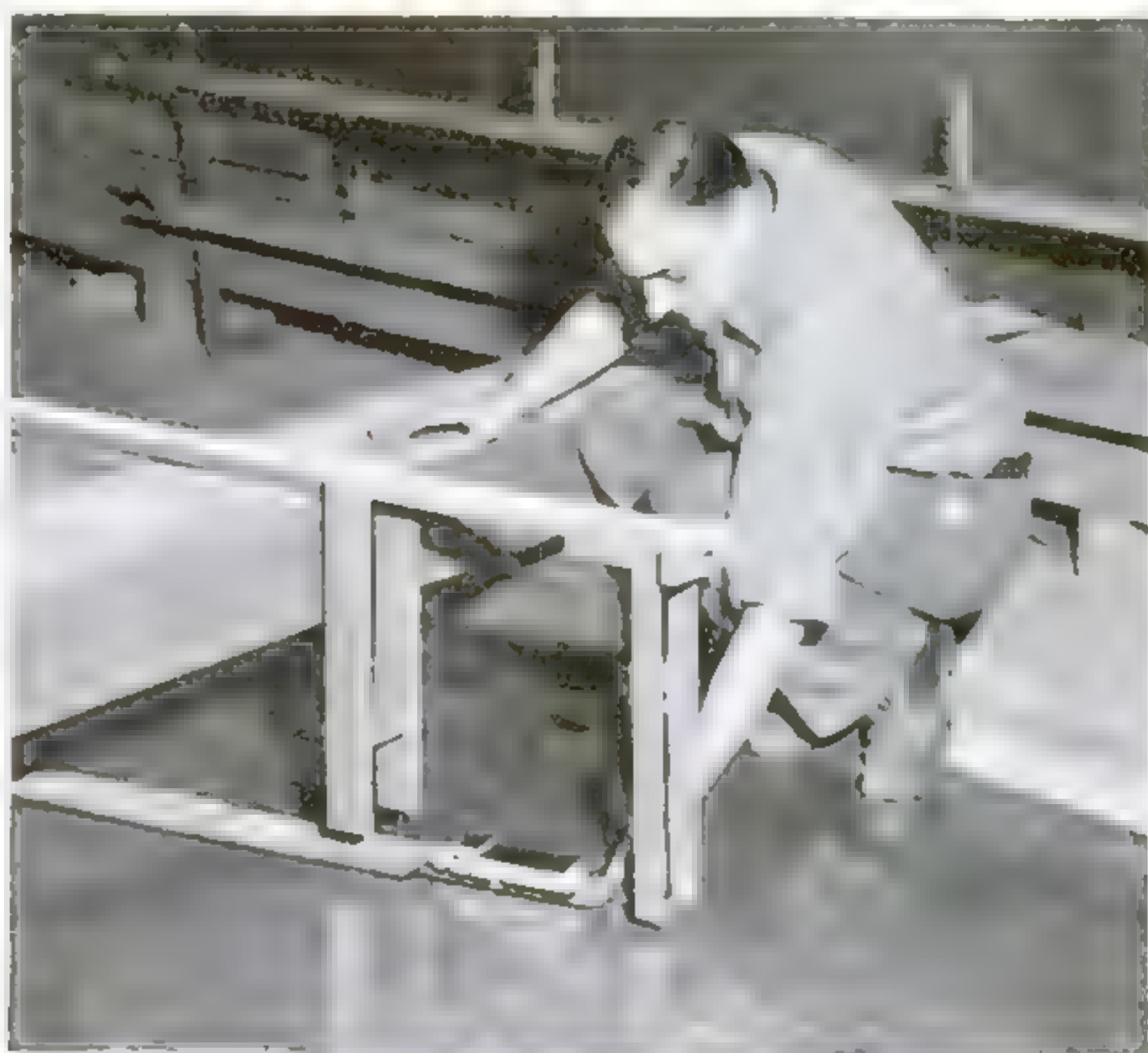


CHEVROLET

The Complete Car - Completely New

*Monthly*RAYMOND J. BROWN, *Editor*

Model Rivers SHOW WAY TO Flood Control



An engineer at the Hydraulic Research Laboratory of the Carnegie Institute of Technology, Pittsburgh, Pa., releasing a model boat and barge in a miniature waterway

NESTLED in the hills of Pittsburgh, Pa., is one of the strangest laboratories in the world—a model maker's paradise where rivers can be crossed in a single stride, where tiny barges float lazily down concrete-bordered rivulets, and where glass-walled streams tumble in raging torrents over miniature dams.

This modern Lilliput is the Hydraulic Research Laboratory of the Carnegie Institute of Technology where engineers play with toys to study the actions of mighty rivers and

dams. By working with realistic models, they are finding better ways to control the flood waters that each year destroy millions of dollars in property and claim thousands of lives.

Largest of the reproductions in this amazing laboratory are two giant models of the Ohio River in the vicinity of Neville Island, six miles below Pittsburgh. Built of concrete and accurately scaled, they are

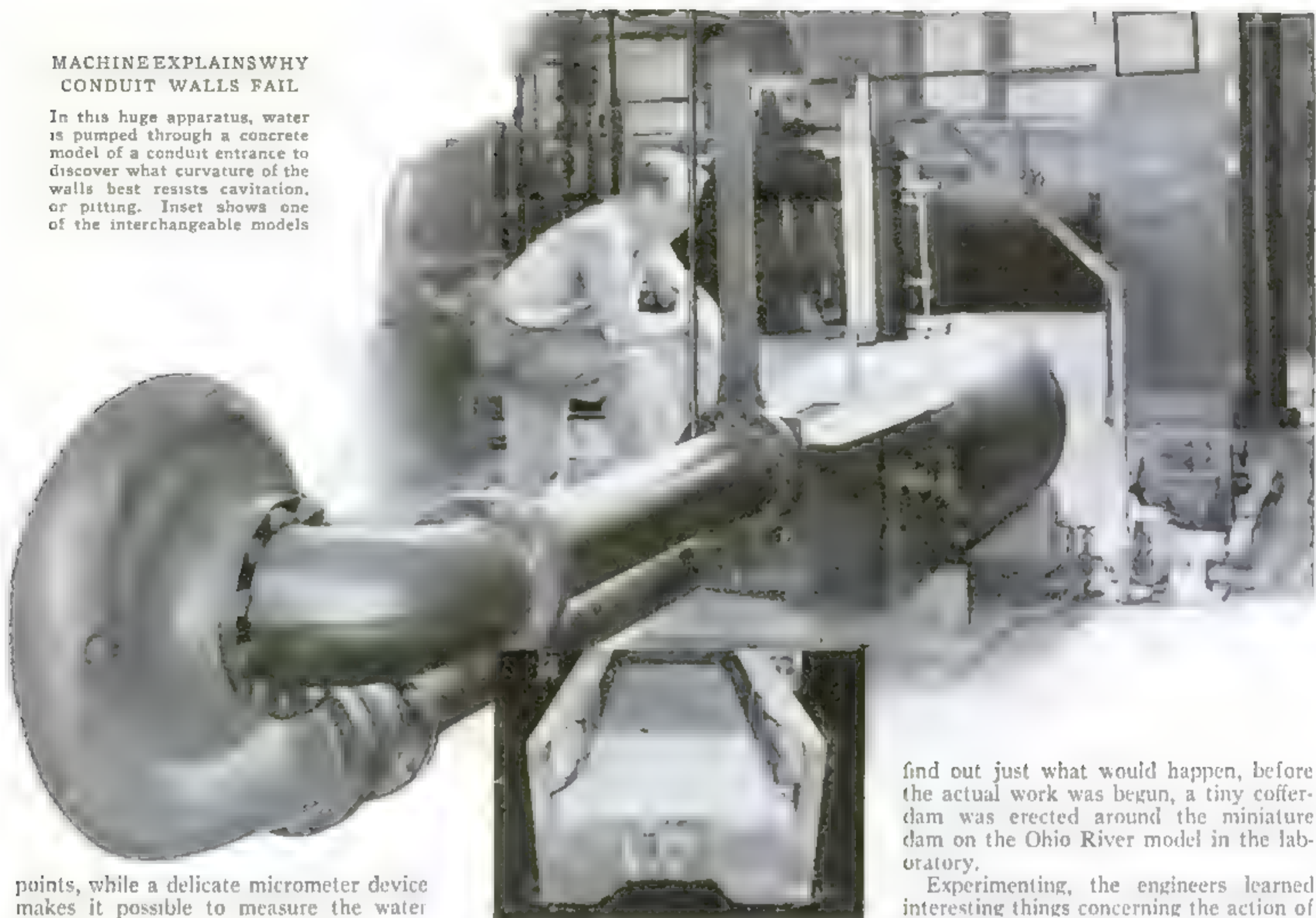
exact copies of the area now being studied.

The biggest model, extending for more than eighty-eight feet across the floor, represents a ten-mile stretch of the river and includes the Emsworth Dam. Supplied with water by electrically operated pumps fitted with valves so that the flow can be controlled to duplicate every natural condition, this model is being used to study proposed methods for providing better control of the waters in the vicinity of Pittsburgh. Gauges in the form of thermometerlike tubes accurately register the pressures at various

By ROBERT E. MARTIN

MACHINE EXPLAINS WHY CONDUIT WALLS FAIL

In this huge apparatus, water is pumped through a concrete model of a conduit entrance to discover what curvature of the walls best resists cavitation, or pitting. Inset shows one of the interchangeable models



points, while a delicate micrometer device makes it possible to measure the water levels to small fractions of an inch.

Another realistic model, now being constructed, is to be used as a novel flood-predicting machine. For years past, the business of calculating just when the crest of a flood will hit a given point, and how high it will be, has been largely a matter of mathematical guesswork. Readings taken at gauge stations located along the river above the region are used in the calculations. But last March, the high flood waters completely wiped out the communication facilities and rendered the stations useless. To guard against this, it is planned to establish automatic gauges equipped with radio equipment to transmit the readings to a central point where all flood forecasts will be made.

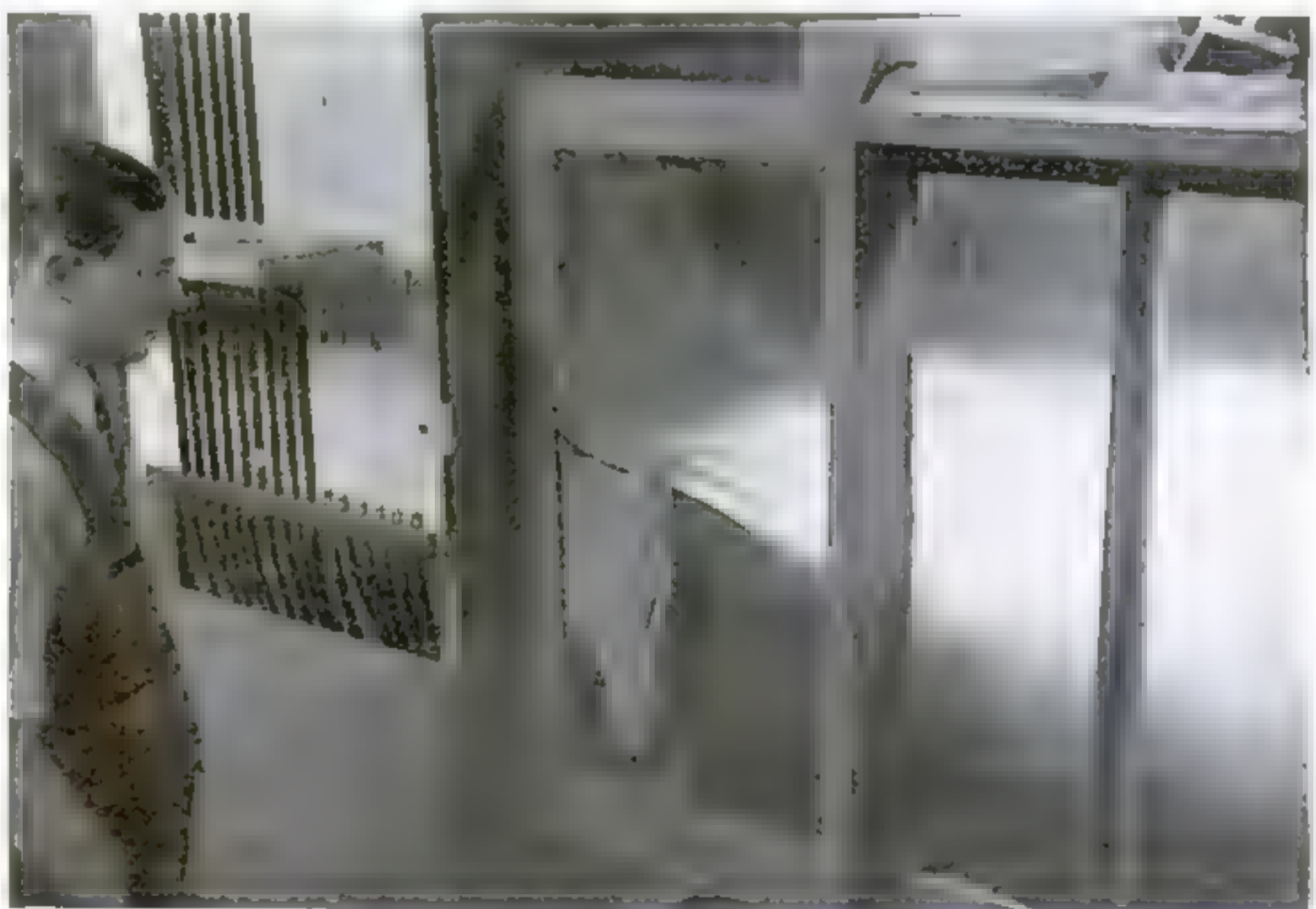
With these readings and the model, experts will be able to determine in a few minutes exactly when the flood will reach a given point, and how high the water will be, hours before it actually strikes. Suppose, for instance, that a gauge station thirty miles above the city radios that the water is fifteen feet above the normal level. Engineers setting the model river into operation will adjust the water level at this point on the model to correspond to fifteen feet and watch exactly what happens farther down the stream. This single model, it is hoped, will save millions of dollars and thousands of lives by taking much of the guesswork out of flood forecasting.

In another part of the laboratory is a larger model of the Emsworth Dam in the Ohio River. Here a number of problems are being worked out in connection with the work of remodeling the dam and repairing the damage caused by the March, 1936, flood.

The remodeling project, now under way, includes the installation of crest gates to raise the dam's effective height. This will provide better control of the navigable waters in the Pittsburgh area, and will eliminate two other dams, one in the Monongahela River and the other in the Allegheny River. To hold the water back while work was being done, it was decided to build a cofferdam around one half of the Emsworth structure at a time. To

find out just what would happen, before the actual work was begun, a tiny cofferdam was erected around the miniature dam on the Ohio River model in the laboratory.

Experimenting, the engineers learned interesting things concerning the action of the currents around the dam. They dropped confetti—the kind you throw at parties—on the water and, by means of a camera mounted above the model, photographed the currents made visible by the floating bits of paper. Fairly long exposures, of one second or so, were used, so that the velocities of the paper pieces would be indicated by the lengths of the streaks they made on the photographic film. In this way, areas where the water was running swiftly, quiet regions, and whirlpools were all clearly revealed.



Behind glass walls, water rushes over the bottom of a miniature dam spillway. Engineers study the model to determine what effect the water flowing over a real dam will have on the river bed

There was, the engineers discovered, a region just below the half of the original dam not protected by the cofferdam, in which the water swirled rapidly. So the laboratory's toy boats and barges were brought into action. These are scale models of actual river stern-wheelers and flat-bottomed barges loaded with coal, iron, and other freight. It was found that a boat entering the whirlpool area was seized as if by invisible hands, and whirled around and around.

So the set-up was changed, and tests were made again and again until a satisfactory arrangement was worked out. The findings enabled the construction engineers on the actual project to proceed with a knowledge of what would happen to the river and its traffic.

Studies also were made of the control of river currents near the locks of the Emsworth Dam, so that heavily laden barges being pushed by steamers would enter the locks, instead of being swung to one side by small eddies and cross currents. To record the actual path of the tow as it entered the locks, the special overhead camera again was brought into play. Held by a clamp just above the locks, the string of toy barges was released in such a way that it floated down-stream without being accidentally pushed one way or the other. Clicking the camera shutter at regular intervals, the engineers obtained a series of images of the barge string. In this manner, the exact way in which the currents influenced the movements of the barges was recorded.

Last year, the flood waters of the Ohio River caused considerable damage to the river bank near the Emsworth Dam. At a point just below the dam, the currents dug deeply into the bank, carrying away a number of buildings and a great quantity of earth. Before making repairs, however, the engineers experimented with their giant model. Setting the miniature river in motion to reproduce flood conditions, various types of repairs were tried. By making repeated tests, the best way of filling in the area was determined long



OLD MAN RIVER IN MINIATURE

Model of the Emsworth Dam and locks on the Ohio River, used in flood-control studies. Right, photograph of confetti floating on water.

before a spadeful of actual earth was turned.

Although a great deal of the work has to do with existing dams, the Hydraulic Research Laboratory also serves as a proving ground for dams and flood-control structures yet to be built. Much of the research now in progress concerns the proposed Bluestone Dam to be constructed by the Government on the New River, at Hinton, W. Va. This dam, one of the largest concrete structures in the eastern part of the United States, will control the waters of the New and Kanawha Rivers, providing flood protection, water conservation, and hydro-electric power for Charleston, W. Va., and surrounding cities.

All the major hydraulics problems that arise in connection with the design of this

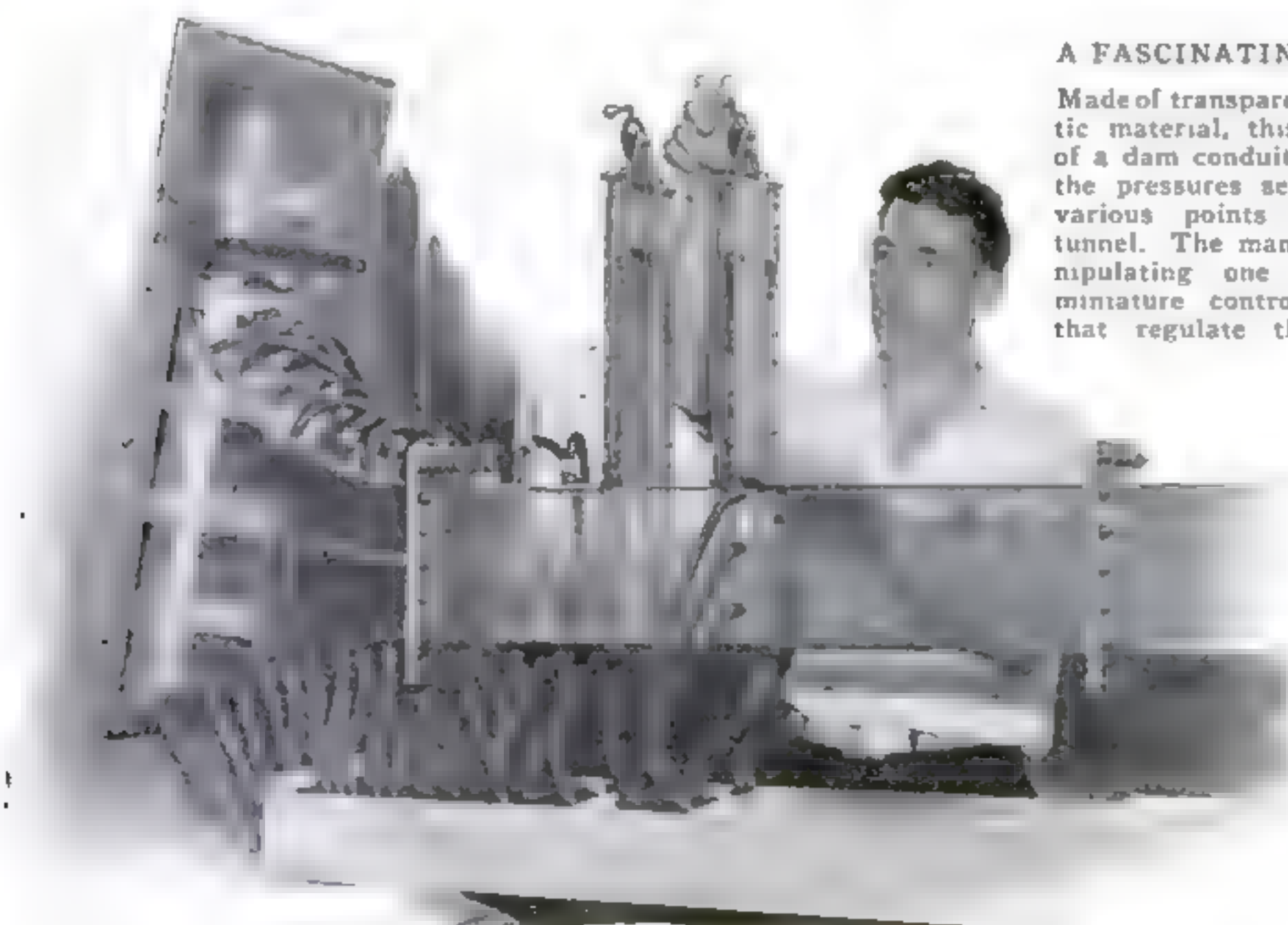
dam are being worked out with models under the direction of U. S. Army engineers. Steepness and other characteristics of the dam site are such that a number of unusual problems of water behavior have to be solved. One problem is the prevention of erosion of the river bed below the dam. Water will rush over the dam from a height of 155 feet, and will strike the bottom with such great force that, unless special precautions are taken, the bed will be worn away in a short time. A number of models have been constructed for the purpose of finding the best way of breaking up the solid stream of water into small, harmless jets.

When a dam is used for generation of electric power, the water used to turn the turbines must travel through conduits or concrete-lined tunnels. It is important that the engineers know exactly how the water travels through these tunnels, and what pressures are generated against various parts of the walls.

To study the action of water in one of the Bluestone Dam conduits, one of the most beautiful models in the laboratory was made. It is built entirely of a transparent plastic substance, and represents a portion of the dam, the conduit, and the control gates. It is an accurate scale model of a tunnel ten feet high and five feet, eight inches wide, through which water will rush with a velocity of eighty-three feet a second. Scores of rubber tubes emerge from points where water pressure is greatest, and run to a device that looks somewhat like a glass pipe organ. This is (Continued on page 115)

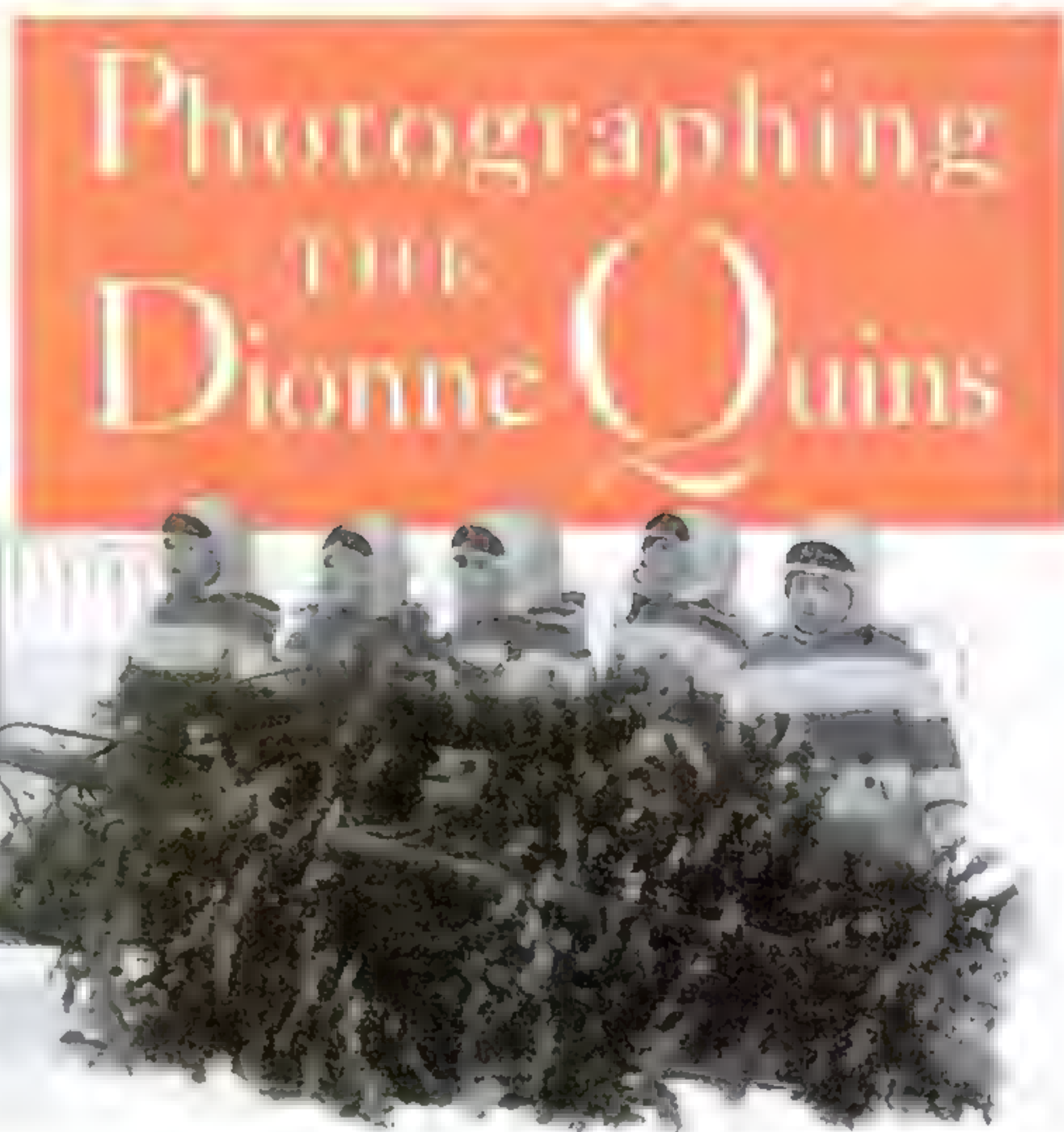
A FASCINATING TOY

Made of transparent plastic material, this model of a dam conduit gauges the pressures set up at various points in the tunnel. The man is manipulating one of the miniature control gates that regulate the flow.





Fred Davis posing his five famous subjects for their Christmas picture



COPYRIGHT 1937, N E A. SERVICE, INC

THIS INTERESTING ARTICLE TELLS ABOUT THE MAN WHO HAS A MONOPOLY ON MAKING STILL PICTURES OF THE FIVE MOST FAMOUS BABIES IN THE WORLD

SHOW one of the babies stooping over and reaching into a basket." That was what the specifications called for. But Fred Davis, who holds one of the world's most enviable photographic positions, had just about made up his mind that another set of detailed directions would become a mere scrap of paper. For although the tiny model stood by the basket readily enough, she refused to stoop over and reach into it. Davis tried every trick he could devise. He put his wallet into the basket; his watch. Then he started adding whatever loose objects he could find in the room. Still the little model refused to bend her back. Then he found the magic charm. A cake of soap! The baby stooped over to lift it from the basket, the camera shutter clicked, and another picture of one of the world's most famous babies was made.

Fred Davis is official photographer of the Dionne quintuplets at Callander, Ont. As staff cameraman for the Toronto Star, he was the first news photographer to make a picture of the now famous babies, shortly after they were born in May, 1934. More or less by right of conquest, he became the only cameraman who is permitted to make still photographs of the quins. He shoots all the pictures distributed by the Newspaper Enterprise Asso-

ciation, which holds exclusive contract for such pictures. Every official quintuplet photograph published in newspapers, on picture post cards or elsewhere; every picture that brings thousands of dollars into the babies' swelling bank account because it is used for advertising purposes, even each still picture made while the quins are being filmed for a feature motion picture, is the work of Davis.

Although photographing the quintuplets may be a job that almost any cameraman would give his eyeteeth to hold, it is by no means a cinch, according to Davis. The pictures he obtains appear the more remarkable when something is known of the conditions under which he works. It will benefit any photographer who attempts to make pictures of children, to observe some of his methods.

First of all, Davis is a man who looks as if he would get along well with children. He also gives the impression that he can be hard as nails with grown-ups, when occasion demands. He must be a patient man. Anyone who has attempted to make a successful snapshot of a single two-year-old possessing an abundance of

vitality knows how much patience is required to get a satisfactory result. Multiply that by five, and you have a faint idea of what it takes to make a successful news or advertising shot of the quintuplets.

After patience and an ability to get along with children, come such technical details as lighting, camera equipment, films, and exposures.

The matter of lighting is of utmost importance. Whenever possible, the famous babies of Ontario are photographed in their play yard or any other place where sufficient daylight illumination is available. Daylight is not harmful to young eyes, and it permits the short exposures necessary to "stop" motion.

Whenever artificial lighting is required, as in winter months when the quins are indoors and natural daylight is weak, the lighting arrangements are dictated not by the requirements of good photography, but by medical precautions necessary to prevent injuring the eyes of the babies. Neither Davis, Dr. A. R. Dafoe, nor anyone else connected with the work thinks of doing anything that could cause eye strain or fatigue.

When the quintuplets were very young, and before electric power lines were extended to their home, Davis had to use photoflash lamps. Later, when electric power was available, better means of lighting were employed. Taking a lesson from Hollywood motion-picture technicians, Davis adopted 2,000-watt movie flood lamps as standard light sources. These lamps are similar to ordinary incandescent bulbs, ex-

By
WALTER E. BURTON

cept that they produce more light for each watt of current consumed, and have shorter lives. Davis never uses more than three such units at a time; and he arranges them to provide the desired illumination for making the exposure, and for bringing out or modeling the features of the babies. If you look at one of the early pictures of the quins, made with photoflash bulbs, and then at a recent indoor shot made with the flood lamps, you can see considerable difference in modeling and note the absence of harsh shadows in the later pictures.

The large movie flood lamps are not used "raw," however. To eliminate all possibility of dangerous glare, each bulb is covered with a silk diffusing screen and a piece of blue glass that makes the light more like natural daylight. It is possible to look directly at one of the lighted lamps from a distance of a foot or so, and not experience discomfort from glare. The quins do not even look around when the lamps are switched on, so soft is the illumination.

Fast panchromatic film, sensitive to all colors, is used in the camera. The blue quality of the light reduces the effective speed of this film, but there is enough illumination to permit exposures of a twenty-fifth of a second at a lens opening of F/4.5. Panchromatic film, sensitive to all colors, is

Cameras checked outside the visitors' gallery at Callander, Ont. Each box is chalked with a number, and the owner is given a ticket

Below, some boys are trying to outwit the authorities by snapping the quins over the specially built fence



superior to film that lacks sensitivity to orange and red, because it tends to reproduce the skin of the sun-bronzed babies in lighter tones.

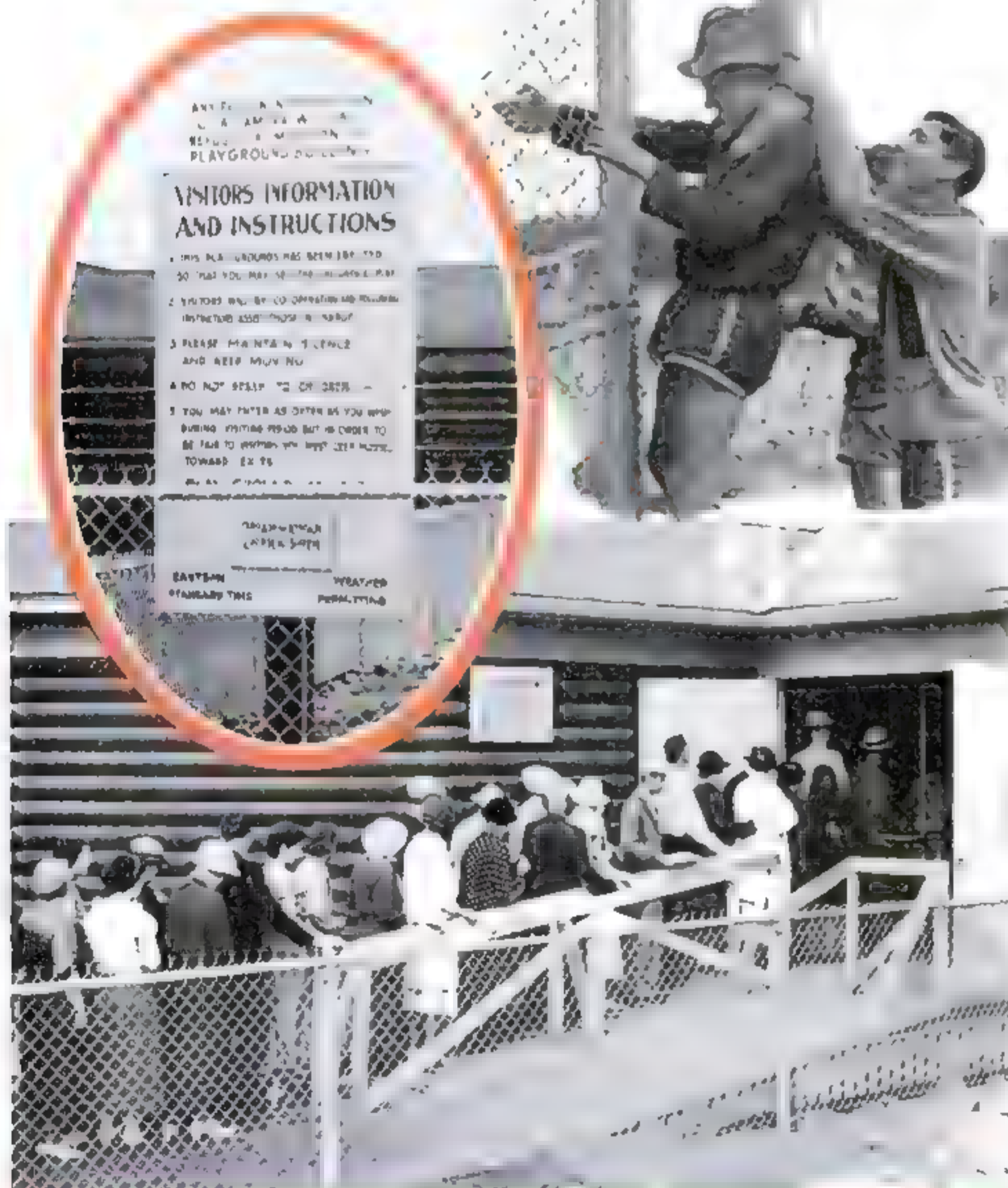
Davis has tried many cameras, from fast miniatures using motion-picture film and making negatives measuring one by one and a half inches, to focal-plane cameras of the type commonly employed by press photographers. The miniature camera proved unsuitable because, although it produced excellent negatives, their small size made it difficult to obtain the greatly enlarged prints demanded by purchasers of the pictures. The instrument finally adopted as the "standard quintuplet camera" is a reflecting type making a four by five-inch negative on cut film. It has a twenty-four-centimeter lens with a maximum speed of F/4.5. With this camera, Davis can work from a low viewpoint, and watch the babies on the ground-glass screen up to the instant of exposure.

The official quintuplet photographer makes it a rule to work with the babies only when Dr. Dafoe is present. At the slightest indication of fatigue or irritation on the part of the quins, he folds up his camera and waits for another day. Sometimes he does not even make an exposure after going to the trouble of setting up his equipment, because the babies do not seem to be in the mood to be photographed. In this work, as in nearly all child photography, the babies themselves are the real bosses.

At best, the task of getting five lively little girls to assume reasonably interesting poses, in positions where they all will show in the same picture, is bordering on the impossible. The babies cannot be forced to do anything. The photographer must wait patiently until they voluntarily assume satisfactory poses; or else employ some sort of strategy, as in the case of the cake of soap.

Davis follows no rigid schedule in shooting the quins. He works much as inspiration and conditions—and the quins themselves—dictate. Part of his task is to invent interesting and story-telling poses. Costumes help a great deal at times. Birthday-cake and Christmas-tree pictures are always interesting to the public.

Practically all the photographs Davis makes of his famous subjects are distributed by NEA Service purely as news pictures. A few (Continued on page 134)



Visitors filing into the observation gallery from which the quins can be viewed in their play yard. The inset shows one of the big signs that warn against trying to smuggle a camera along

FIRE TRUCK LAYS LONG HOSE LINE



This truck carries a mile and a half of hose to tap distant water sources

CALLED the first of its kind, a fire-fighting truck just placed in service in London, England, carries a mile and a half of hose. It can lay either a single or a double line while traveling at fifteen miles an hour. The truck will provide quick aid when a shortage of water occurs and makes it necessary for the firemen to stretch out long lines of hose in order to reach additional sources of supply.



STACKS 4,200 MATCHES ATOP BEER BOTTLE

BY BALANCING 4,200 ordinary kitchen matches on the top of a beer bottle, Thomas H. B. Stagg, of Cleveland, Ohio, has provided a mark for parlor-trick enthusiasts to shoot at. A postman's heavy step on his front porch sent the top-heavy pile crashing, but not before a photographer had come along in time to record the unique feat.

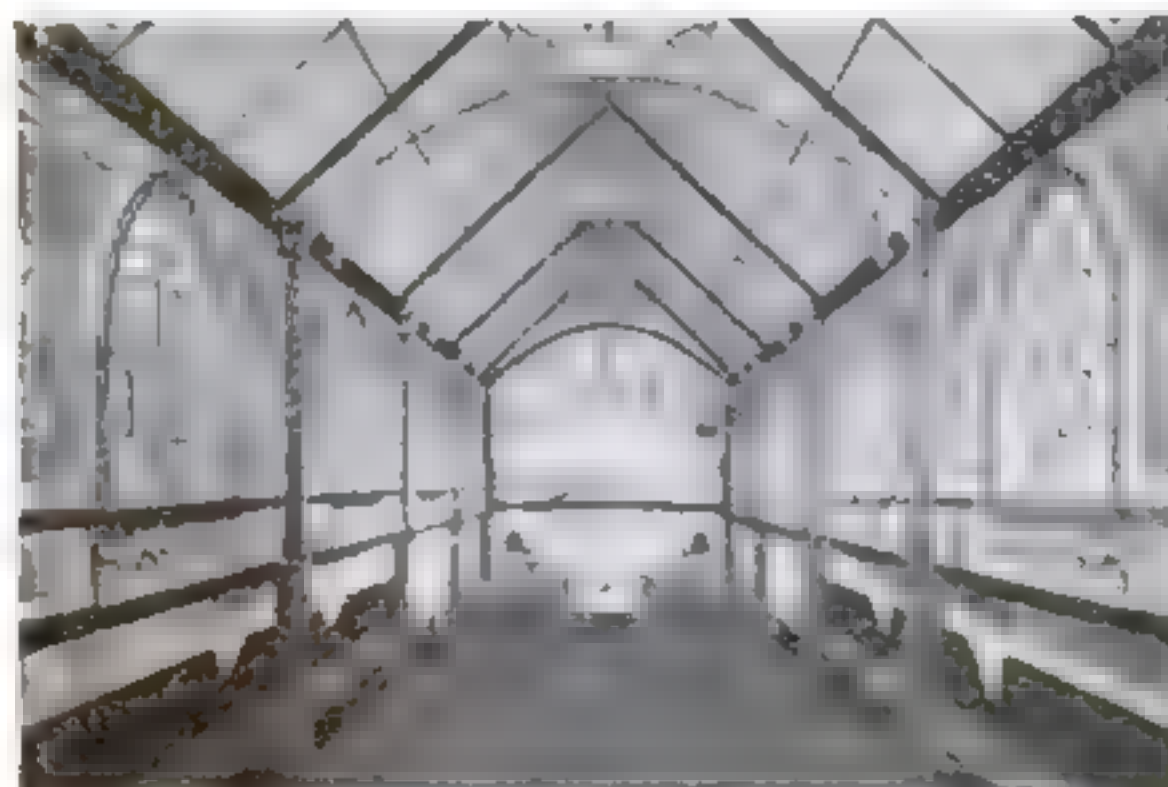
TINY CABLE CARRIES 240 PHONE CALLS



An engineer at the panel that controls messages on the "coaxial" cable

AS MANY as 240 telephone conversations travel simultaneously over an experimental cable less than an inch in diameter, just laid between New York and Philadelphia and successfully demonstrated in its first public test. Doing the work of a standard 480-wire cable as thick as a man's arm, the new "coaxial" cable employs a pair of copper tubes of lead-pencil size. Experts are perfecting the cable for commercial telephony and as a "pipe" for broadcasting television programs.

FLOATING CHURCH BUILT ON SHIP'S HULL



Interior of the floating church. Picture at right shows the odd hybrid craft

ERECTED on the hull of an old ship, a floating church complete with steeple and stained-glass windows, serves a congregation in Argentina. Because they had to ford numerous streams and rivers, the worshippers found it difficult to get to church on Sunday. The problem was solved by building the floating house of worship.

TRAIN ORDER IS LIGHTED

TO FACILITATE nighttime delivery of train orders "on the fly," flash lights are now attached to the conventional "message loops." This illuminates the loop and makes it easy for the trainman to pick up the message as shown above.





STATUE OF A COWBOY MADE OF SHEET METAL

COMPLETE with lariat, boots, chaps, and ten-gallon hat, a unique statue of a cowboy recently displayed at a New York exhibition was built up entirely from sheet metal. The modeler, Lowell L. Balcom, of Silver Mine, Conn., used brass, bronze, and copper in forming the odd figure. By skillful cutting and bending of the metal, Mr. Balcom was able to produce such difficult details as a broad, studded belt and buckle, which can be seen in the photograph reproduced above.

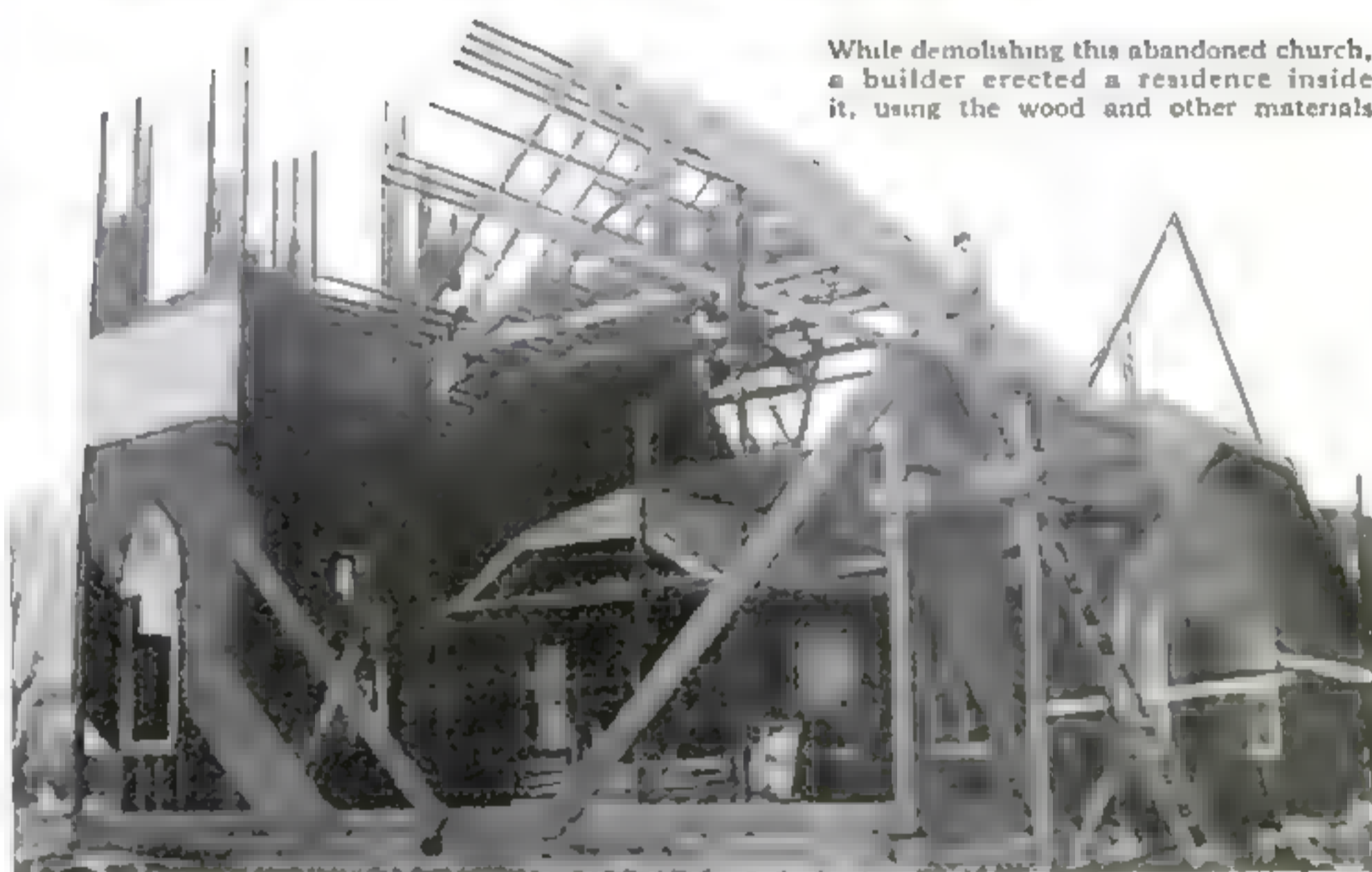
BIRDS ARE BOARDERS IN CANARY HOTEL

CANARY birds are the "guests" in a novel boarding house operated by Mrs. E. J. Karst, of Atlanta, Ga. Most of the feathered boarders are left by owners who are temporarily away from home, and want their pets to have the best of care in their absence. Some of the canaries, however, are "hospital cases," undergoing treatment for various ailments. Comfortable quarters are provided for more than sixty birds in cages ranged on the walls.



"Rooms" in the odd boarding house where birds are kept for their owners

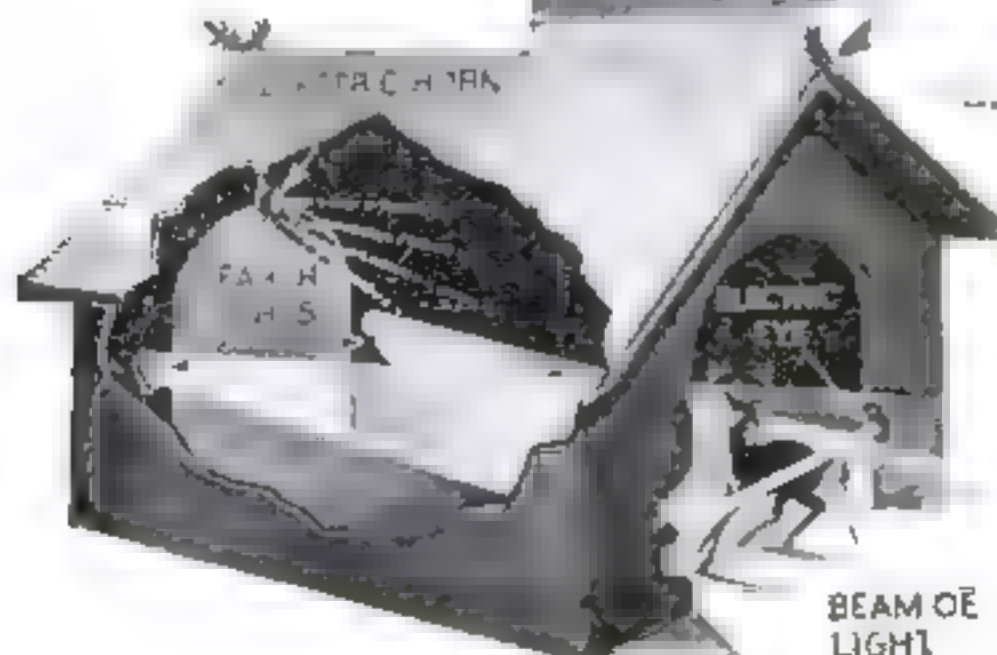
HOUSE IS BUILT INSIDE A CHURCH



While demolishing this abandoned church, a builder erected a residence inside it, using the wood and other materials

HORN AND LIGHTS BAR ROAD TO GAME

Built across the entrance to a German game preserve, this archway contains an electric-eye device that turns on bright lights and sounds a horn, as shown below, when an animal tries to pass through, thus frightening it back



BEAM OF LIGHT

SEARCHLIGHTS and a horn replace a conventional gate on the edge of a German forest used as a game preserve. Installed in a doorless shed, the horn and lights are operated by an electric eye whose beam spans the doorway. If a deer interrupts the beam, the horn blares and the lights flash on, frightening the animal back into the woods.

ERECTING a small house inside of an abandoned church was the odd construction method adopted by a Missouri builder. After purchasing the church to utilize its wood for building materials, the owner moved in for the winter, kept the church furnace going, and started work on his new home unhampered by the cold. Careful planning enabled a good part of the church foundation, floor, and walls to be used intact, while superfluous wooden members were ripped from the church to supply needed materials.

ONE LOCK FASTENS ALL DOORS OF CAR

A DEVICE which locks all four doors of a sedan in one motion has recently been made available to automobile manufacturers. To lock a car equipped with the new system, it is only necessary to turn the key in the right front door, and raise the handle; the other three doors are locked automatically. It is impossible for the user to lock himself outside the car, leaving the keys inside.

GIANT PLANT YIELDS USEFUL OIL



Perilla plants at the U. S. Department of Agriculture experiment station at Gainesville, Fla. In the circle the tiny seed are compared with a match. Right packets of seed brought from the Orient for test.

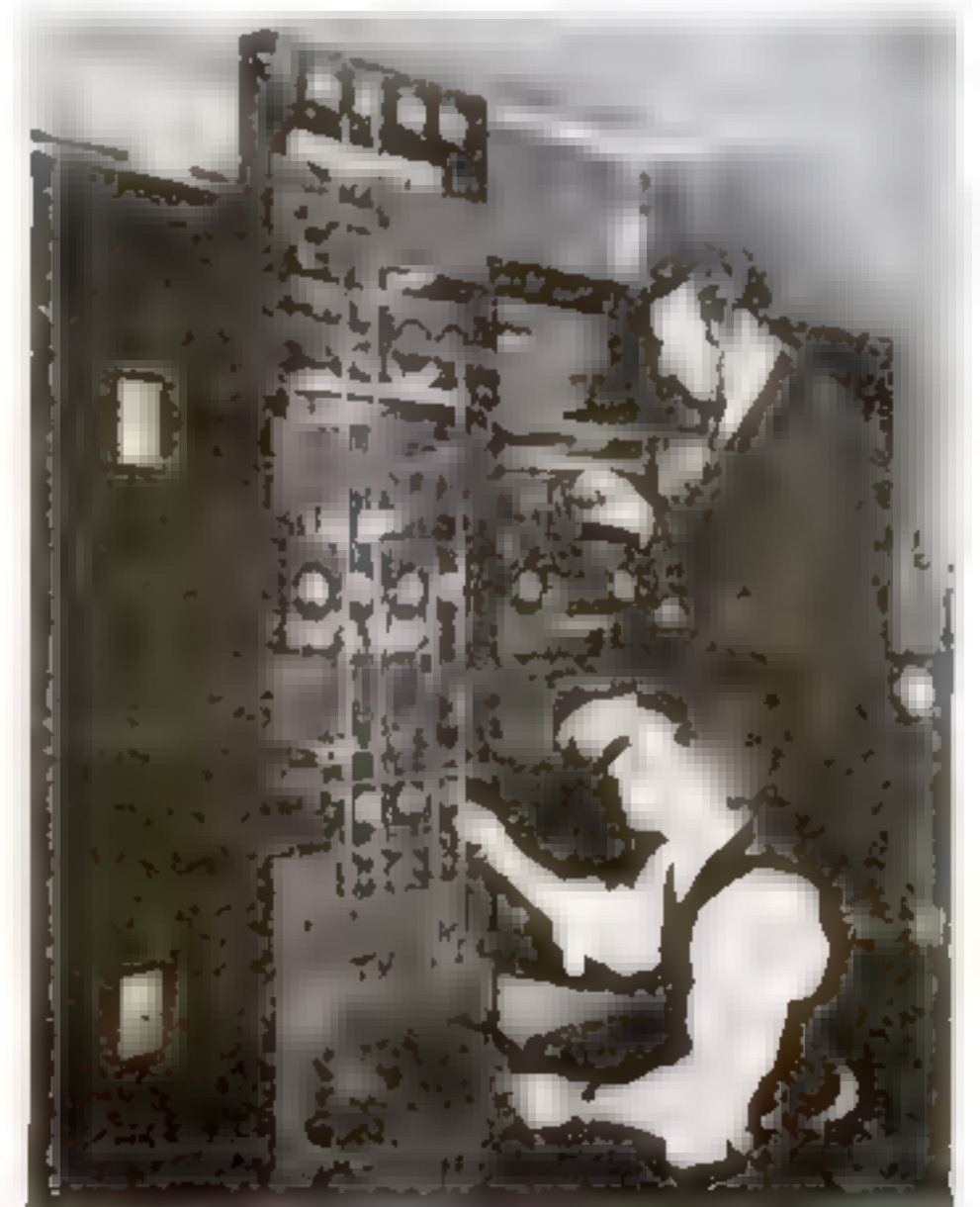
TAPPING a new "vegetable oil well," U. S. Department of Agriculture experimenters at Gainesville, Fla., have reported success in raising and harvesting perilla, a giant Oriental member of the mint family. Its tiny brown seeds, suggesting mustard seeds, hold the valuable perilla oil used in making paint, in waterproofing cloth, and in producing artificial leather. During the first eleven months of 1935 the United States imported more than 69,000,000 pounds of this oil, valued at \$4,211,000. At Gainesville, Dr. F. S. Jamison and his associates have tried four types of seed imported from the Orient and France. In tests, some of the plants attained a height of twelve feet. The seeds are forty percent oil, and the residue material left when the oil has been squeezed out is rich in nitrogen and therefore valuable for fertilizer. In the initial trials, on small plots, the yield of seed was at the rate of 900 pounds to the acre. Next year, larger areas will be planted and further tests carried on in other parts of the state. It was at the Gainesville station, a few years ago, that pioneer work with tung-oil trees was carried out.

CAMERA ADJUSTS ITSELF TO LIGHTING



An electric eye automatically moves a light filter of varying transparency to give the right exposure.

INVENTED by Prof. Albert Einstein, famous mathematician, and Dr. Gustav Bucky of New York University, a new camera automatically adjusts itself to the correct exposure for existing lighting conditions. Light entering an auxiliary lens strikes a photo-electric cell and causes it to move a screen filter of varying transparency to control the amount of illumination striking the photographic film or plate. Turning a stop disk on the front of the camera changes the size of the lens opening and the light filter reacts accordingly.



RADIO ECHOES EXPLORE THE UPPER ATMOSPHERE

TO EXPLORE the earth's upper atmosphere and determine its effect on radio transmission, magnetism, and the northern lights, two scientists of the Carnegie Institution, Washington, D. C., have perfected a unique radio apparatus. Radio waves sent out from the device on a number of different wave lengths strike the various layers of ionized atmosphere from forty to 300 miles above the earth, and are reflected back to their source. The timing and other characteristics of these reflected waves are expected to aid experimenters in probing many of the mysteries of outer space, just as echoes from a submarine sounding device, reflected from the sea bottom, can be made to "describe" the contour of the ocean floor. The picture above shows the inventors, Harvey W. Wells, left, and Lloyd V. Berkner, checking the operation of the device.

PALMETTO CUTTER CLEARS MARSHES

PALMETTOS, weeds, and other tough grasses are easily cleared from farm lands with a new cutting machine just introduced. Drawn behind a tractor, the device has whirling rows of sharp teeth made of

specially hardened and tempered steel. The cutter is especially adapted to clearing marsh lands, and is said to have cut down a twenty-three-acre patch of palmettos at a cost of less than five dollars.



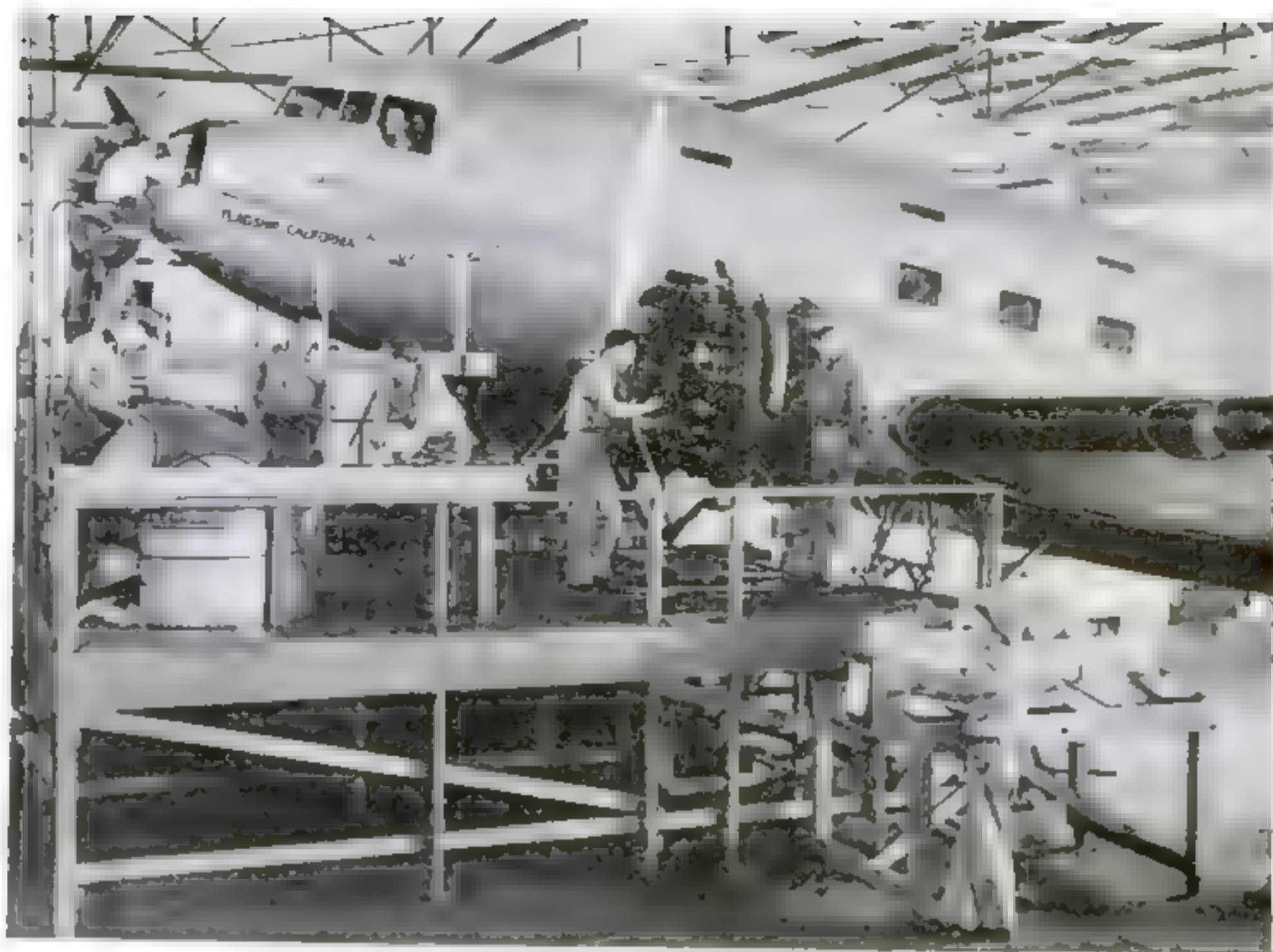
Drawn by a tractor, this machine cuts palmettos and other tough plants to clear land economically.

DRY DOCK FOR PLANES SERVES AIRLINERS

TRANSCONTINENTAL airliners are overhauled in a novel airplane "dry dock" recently placed in service in a Pacific Coast hangar. Planes are wheeled into the wooden dock, which has a series of platforms on several different levels to permit a swarm of mechanics to work on the motors, controls, and instruments all at the same time. By this method, it is said, a giant transport plane can be thoroughly inspected and overhauled within three hours.

NEW PROCESS MOLDS RUBBER ARTICLES

Boors, balls, balloons, and other hollow rubber articles are cast in one piece by a new molding process developed by an English manufacturer. Rubber in liquid form is poured into non-porous forms and subjected to a series of special hardening processes. A rubber weather-observation balloon made by the casting process is shown in the photo below inflated to a diameter of fifteen feet, for comparison with a similar but uninflated balloon.



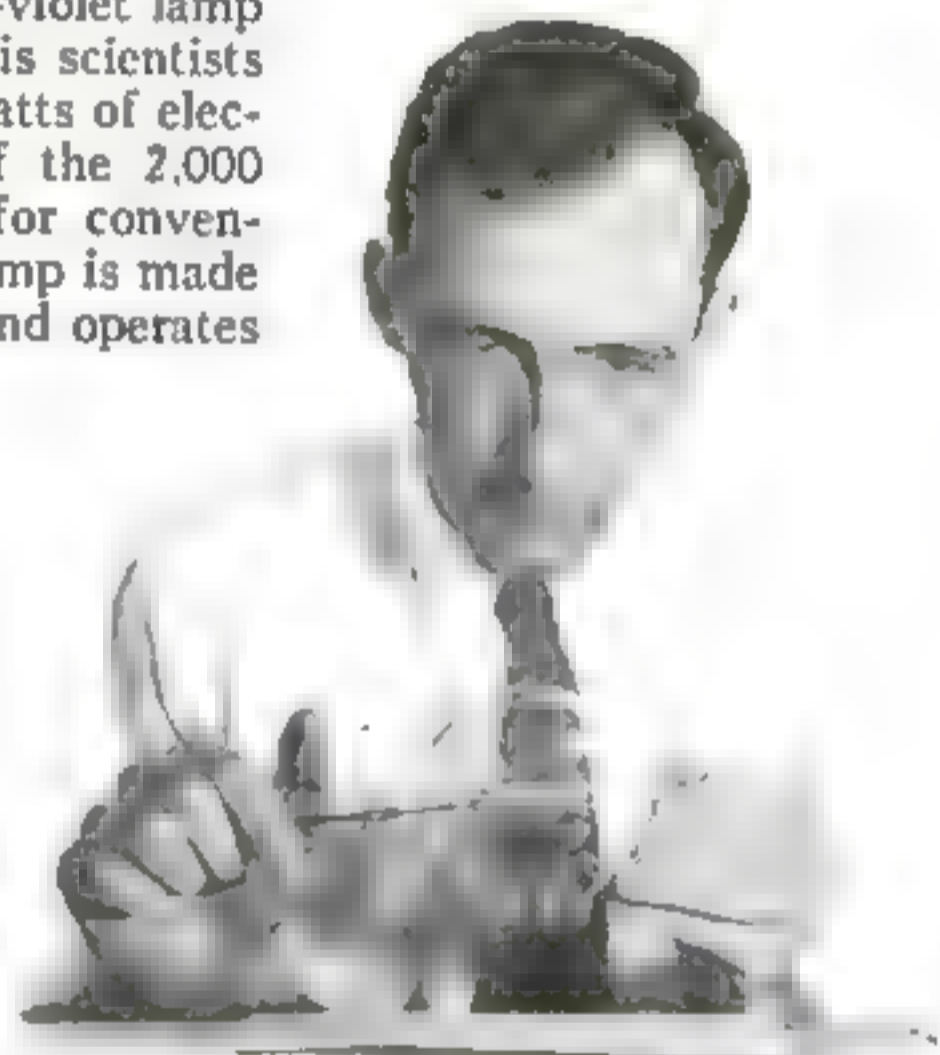
A giant transport plane in "dry dock" while mechanics swarm over it to make tests and replacements



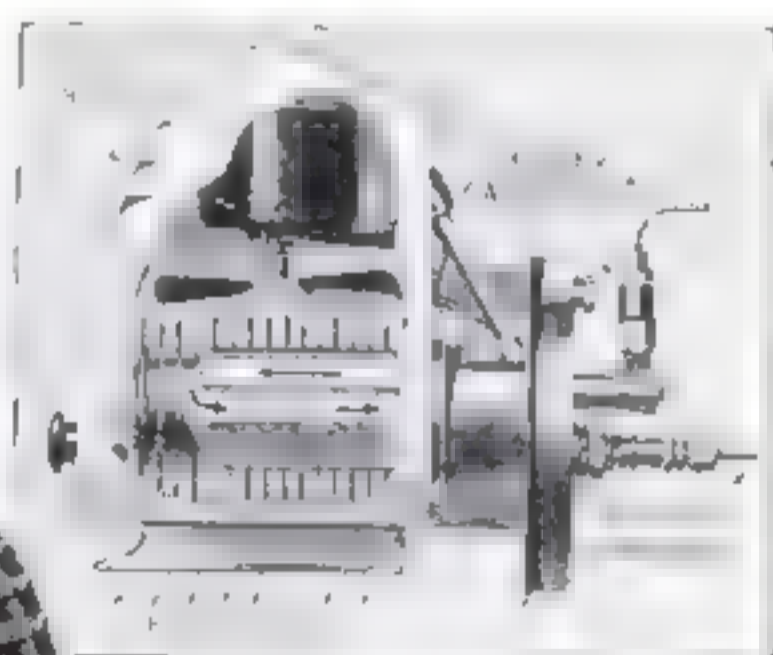
Cast rubber balloon, and a similar one deflated. Rubber boots and other hollow articles can be made in one piece with the new molding process

ULTRA-VIOLET LAMP USES LOW POWER

SCREWED into an ordinary 110-volt socket, a new ultra-violet lamp developed by two Illinois scientists uses only seventy-five watts of electrical energy instead of the 2,000 watts usually required for conventional tubes. The new lamp is made of heat-resistant glass, and operates without special generators or transformers. Resembling a large electric bulb, it has a thin window blown into one side to permit rays to pass easily through the glass. The lamp is expected to reduce the cost of producing radiations for curative and experimental purposes.



Air circulated in this new automobile heater gets its heat from the burning of gasoline as shown at right. Below is a view of the heater



HEATER FOR CAR BURNS GASOLINE



BURNING gasoline warms the air circulated by a new automobile heater just placed on the market. Operating only when the motor is running, the heater is said to supply large quantities of heat while using only a small amount of fuel. Safety valves automatically shut off the device if it becomes too hot.

ROBOT SOLVES PROBLEMS

COMPLICATED mathematical problems that experts would require days to solve are answered in a few seconds by an amazing mathematical robot developed by Dr. John B. Wilbur, Massachusetts scientist. Known as a simultaneous calculator, the machine weighs about a ton, and contains more than 13,000 parts, including 600 feet of flexible steel tape and nearly 1,000 ball-bearing pulleys. The apparatus was designed to eliminate delays in figuring involved research and engineering problems, such as calculating stress on steel bridge sections.



This machine solves complicated problems in a few seconds

Planes Hunt

By
**GEORGE W.
MEHRTENS**



Agents of the U. S. Bureau of Fisheries have taken to the air in their war upon poachers and trap robbers

SKIMMING above rugged mountains and forest-bordered streams, patrol planes of the Federal Bureau of Fisheries soon will resume their relentless warfare against the racketeers of the north, the salmon thieves and illegal fishermen of the Alaskan waterways. Aided by fast Government cutters and backed by the authority of the United States Marshal's office, these wardens of the wilderness are stamping out the pirates who, in former years, have robbed the legitimate salmon fisheries of hundreds of thousands of dollars.

When the spring thaw brings the world's greatest salmon runs to Alaska, sloops, dories, and gas and Diesel-powered fishing boats will go into action. Between late May and early September, most of Alaska's population will be engaged in salmon fishing. From the northern Canadian border to the Bering Sea the silvery beauties will be fighting their way up countless rivers from the sea to their spawning grounds. Traps and seines will yield ton after ton of "pinks" and "reds" to be put up in cans for America's tables. And upon this great enterprise has preyed as tough a collection of thugs as ever plagued a crime-ridden metropolis. Well equipped with rifles, pistols, and high-powered motorboats, the members of a small but highly organized gang have thrived upon the combined returns of illegal fishing and downright piracy.

Picture a commercial fish trap not far from the mouth of an Alaskan river—a netted inclosure teeming with 40,000 captive salmon. At twenty cents apiece, that

offers a good night's haul for a river bandit. Under cover of darkness, the shadowy forms of speedboats, running without lights, approach the trap. A watchman is guarding it. A moment later he is slugged into unconsciousness and left bound and gagged.

Blocks and tackle rattle softly. Up come the nets. Tons of valuable fish go slithering into the holds of the pirate craft. The well-timed raid is completed with business-like efficiency, and the poachers make off with their haul. It will bring a handsome price from a "fence" who specializes in disposing of stolen salmon—one of the odd criminal sidelines of the racket—or an even better figure if the thieves themselves are willing to risk attempting to sell their loot on the open market.

Such was the state of affairs that faced commercial fishing interests not long ago. By the swiftness and careful timing of their forays, the trap robbers managed to play hide-and-seek with the law. Their booty,

since it could not be traced, constituted no damaging evidence if found in their possession. About the only hope of successful prosecution lay in catching them in the act, and no one knew where they would strike next.

Then the Bureau of Fisheries and the office of the United States Marshal mobilized their forces. Airplanes were pressed into service. And the salmon packers, themselves, organized regiments of vigilantes similar to those created in California in the hectic period of the early gold-rush days. Fighting fire with fire, the outraged citizens of Alaska bought speedy motor boats and employed armed guards to protect their interests.

Many a thieving marauder got the surprise of his life when he sneaked up in the dead of night to rob a fish trap. Instead of a lone watchman, who could easily be overpowered, the fish pirates were met by a miniature battleship, manned with experienced agents willing to shoot it out. When the gangs tried to escape in boats that heretofore had been the fastest in Alaska, they were pursued in boats that were even faster.

As plundering fish traps grew too hot for them, however, the pirates began developing more intensively another of their illicit sources of income—salmon fishing in closed waters and at illegal seasons.



A field man of the Bureau counting salmon as they pass the gate of a weir. This method is used to determine the size of the runs

Alaskan Fish Pirates



Fishermen dragging a seine ashore on an Alaskan estuary. It is to protect legitimate fishermen like these, as well as to preserve the valuable salmon runs, that the Government wages its fight on fish poachers. Below, a native fishing with a hand net

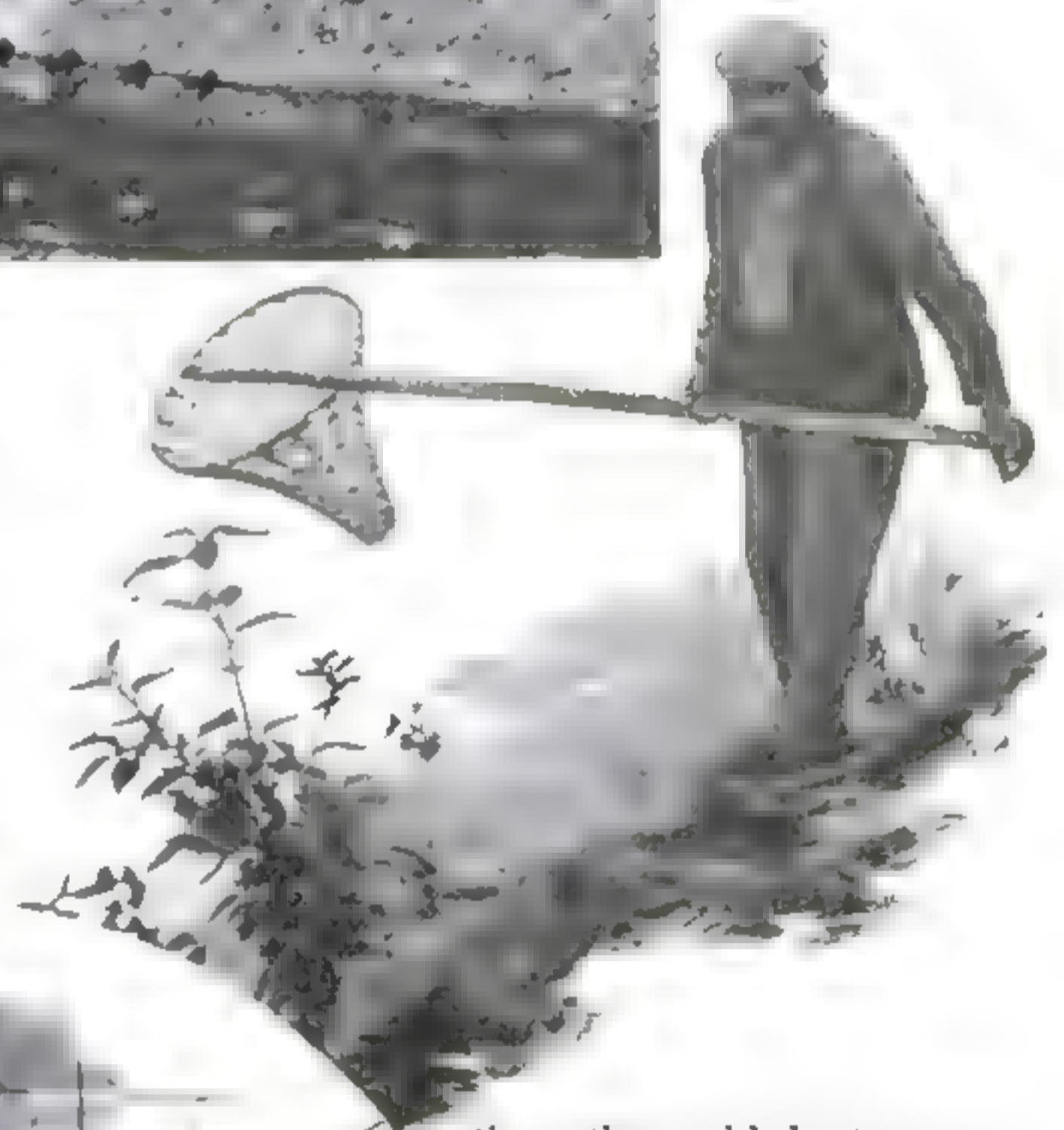
As long as any Alaskan can remember, tough characters among the Indians and half-breeds have eked out a hand-to-mouth existence by dipping for salmon with hand nets in forbidden waters. But the big-time gangsters had no use for the methods of these small fry. With their easy pickings from salmon traps vanishing, they went in for illegal fishing on a grand scale, literally straining whole lakes for their catch. Their greed was their undoing. It brought them squarely into conflict with the U. S. Bureau of Fisheries, which supervises the Alaskan salmon industry to preserve its riches against just such wasteful looting.

To conserve the world-famous runs for posterity, the Government exercises vigilant control over the taking of salmon. Methods of fishing permitted in some areas are banned in others. Fishing with hand nets and seines is forbidden within a certain distance of the mouths of streams. Not infrequently, the Bureau of Fisheries closes an entire fishery for a while, to allow more salmon to reach a spawning ground and deposit their eggs.

From years of experience, the Fisheries men have learned that fifty percent of the salmon must escape if the fish are not to be exterminated, and they enforce this common-sense rule. The seemingly impossible task of actually counting the salmon is one that the Bureau's experts have solved. To learn whether a run is normal, increasing, or diminishing, a "counting weir" is erected across a stream. Made of inclined planking, it leaves a gap at the center through which all the salmon must pass. An observer with a mechanical counter in his hand, perched in a tiny shack on stilts above the gap, regis-

ters the number of fish that pass in a given time. With these observations as a guide, the Bureau frames its regulations for legitimate fishing operations.

Unconcerned with such regulations, large-scale poachers menaced the whole conservation program, as well as the profits of the law-abiding fisheries. To track down



A haul worth several thousand dollars being removed from a fish trap under guard of a Bureau of Fisheries cutter, to balk possible robbery

the outlaws with boats was useless. Thousands of bays, streams, and inlets offered happy hunting grounds for the salmon racketeers. They could readily find seclusion from prying eyes, for Alaska's 586,400 square miles are populated by little more than 30,000 whites—the rest of the inhabitants being Aleuts, Indians, and Eskimos.

Now, the Bureau of Fisheries men patrol this wild, lonely territory in fleet, high-powered planes. Penetrating into the interior and flying hundreds of miles a day, they can easily spot boats in closed areas. Aided by the airplane, the Government agents have now virtually succeeded in stamping out the "bootleg salmon" racket. Illegal fishing, once carried on brazenly in the open, has become an undercover profession too risky to pay. One by one, the racketeers have given up their losing battle with the law.

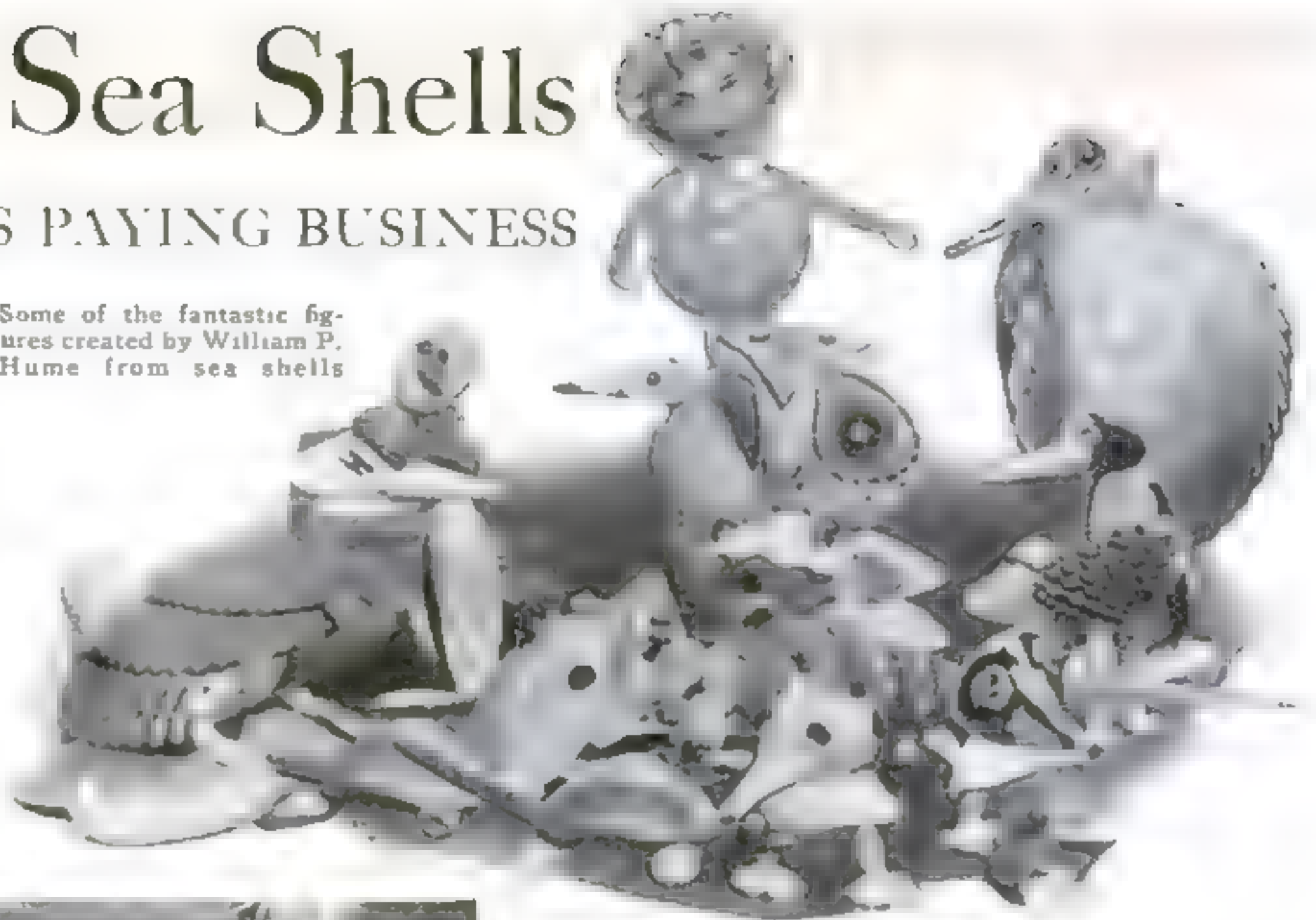
Toys From Sea Shells

ODD HOBBY BECOMES PAYING BUSINESS

WITH sea shells brought from all over the world, William P. Hume, of Charleston, S. C., creates objects of art and utility—lamp stands, place cards, flower vases, beads, and dolls. His Charleston shop, in addition, is a veritable Noah's ark of animals made from shells—miniature giraffes, eagles, pelicans, penguins, owls, monkeys, frogs, chickens, love birds, and butterflies. Many of the shell animals now sold in ten-cent stores were originated by Hume. His latest creation is a Jabberwock, the imaginary creature of Lewis Carroll's "Through the Looking Glass."

Twenty years ago Hume began collect

Some of the fantastic figures created by William P. Hume from sea shells



Hume displaying a few of the different kinds of shells he uses in his strange art. They range in size from tiny baby shells to giants a foot or more in length.

Newly received shells being scrubbed with muriatic acid on a toothbrush to remove foreign deposits and bring out the dainty colors.



Shells of the strange "sand dollar" being broken open to obtain the tiny white inside bones, which are used for small parts in many of the figures. At the right are "Alice and the oyster chorus," as conceived by Hume.

ing shells as a hobby. In a back room, he has more than 18,000 different kinds filed away in cigarette tins, cigar boxes, glass jars, and paste-board containers. They are of almost every hue of the rainbow, and vary in size from midgets barely one sixteenth of an inch across, to giants a foot or more in length.

When he receives new shells, Hume brings out their color by scrubbing the surface with a toothbrush dipped in a weak solution of muriatic acid. In creating the hundred and one items which he turns out, he employs a variety of tools—cuticle knives, jeweler's tweezers, razor blades, a small electric grinder, and crochet needles with the hooks filed off.



In the back room of the shop, filed away in cigarette tins, cigar boxes, and other containers, is a collection of shells including more than 18,000 kinds.

Snake Fights Provide New Sport

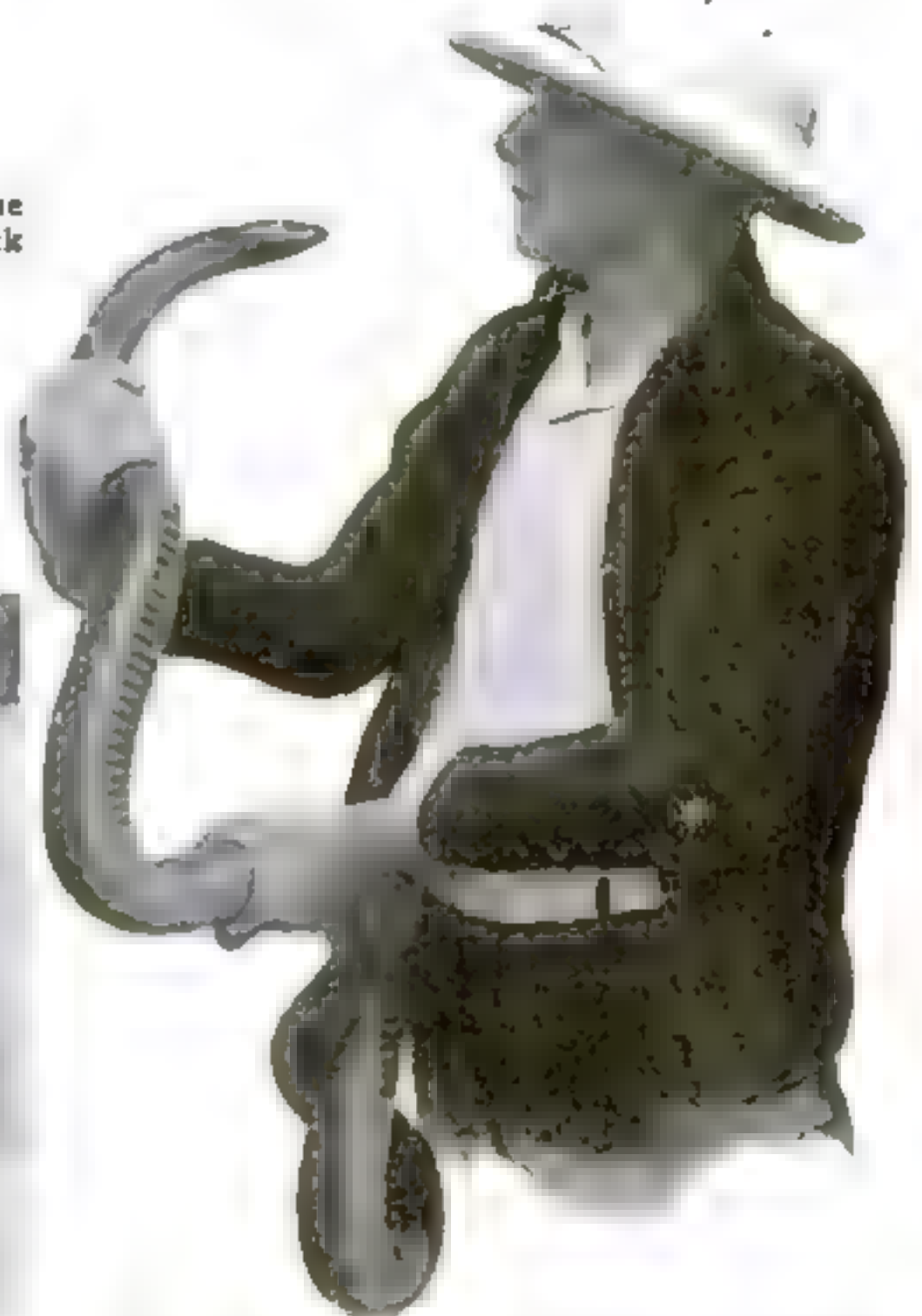


The beginning of the battle. "Texas Jim" Mitchell, right, lowering the indigo snake to the ground while an assistant holds the five-foot diamond-back on the end of a hooked stick

BLACK lightning is pitted against deadly fangs when a Florida indigo snake encounters a diamond-back rattler. The action photographs on this page, snapped by our staff photographer at "Texas Jim" Mitchell's famous reptile farm near Sarasota, Fla., show how the non-poisonous blue-black indigo can outmaneuver and kill its deadly rival. Both contestants in this strange death struggle weigh the same. The indigo snake, nearly seven feet long, has its speed and immunity to poison; the diamond-back, its thick-set body fully five feet long, has its hair-trigger strike and its curving fangs.



The indigo snake, fast enough to avoid the strike of the rattler, wriggles toward its coiled foe



The winner. Harmless to man, the indigo snake is giving valuable assistance by killing the dreaded diamond-backs and water moccasins of Florida and other southern states



Circling its enemy in a series of starts and jerks, it tries to bewilder the diamond-back. Frequently, it darts in and pauses, weaving its head rapidly from side to side

Careful only that the rattler does not reach its head, the indigo loops its body about its enemy while the diamond-back rears into the air and strikes out blindly

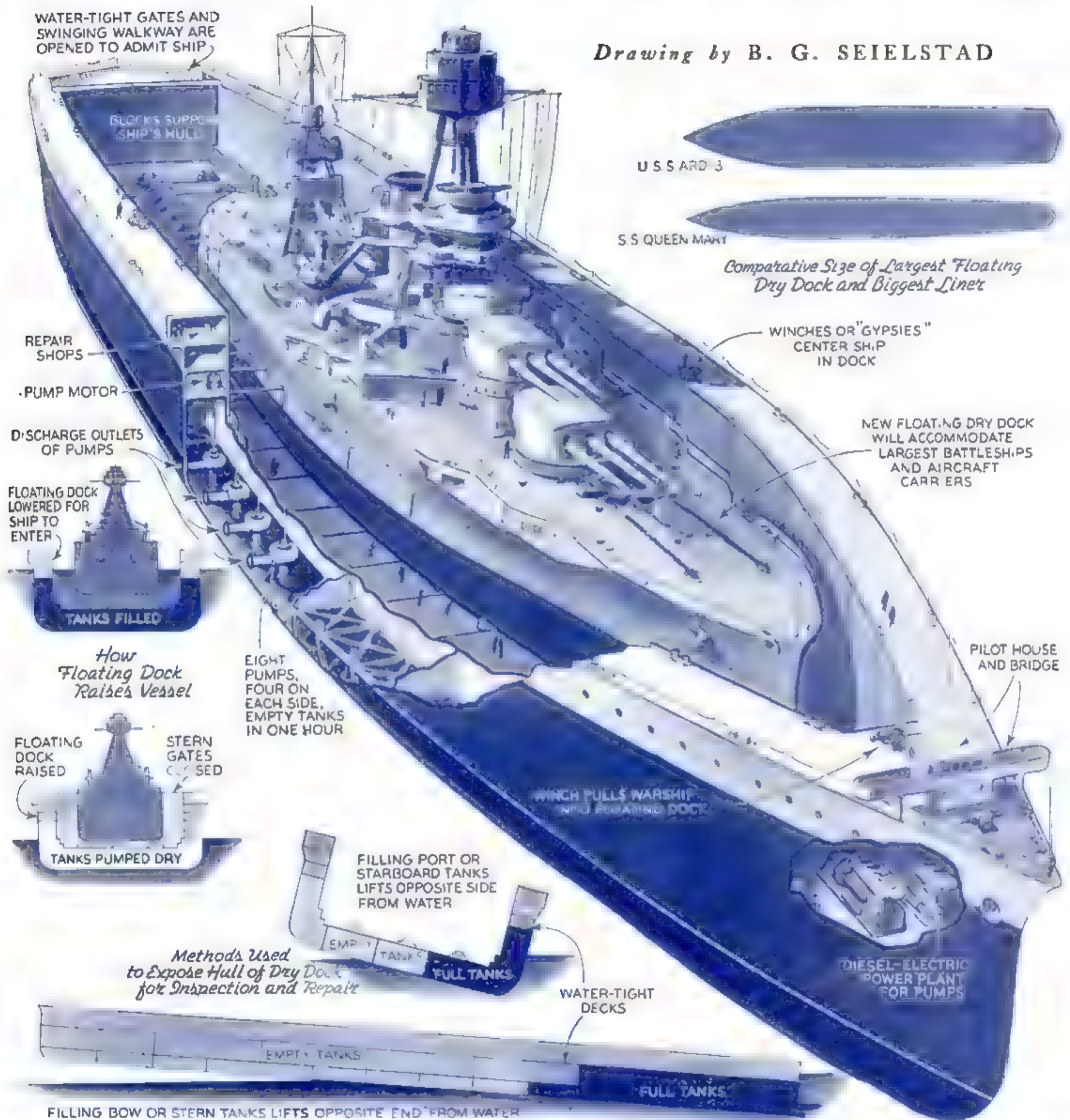


At left, the final round. Bewildered by the weaving motions of the indigo, the rattler is no longer able to follow the movements of its head. Here, the indigo is in position to snap its teeth into the head of the rattler, after which it swallows its foe as seen above



Monster Seagoing

Drawing by B. G. SEIELSTAD



Large enough to accommodate the biggest dreadnoughts in the U.S. Navy, this mobile dry dock will accompany the fleet

PLANS just announced by the U. S. Navy Department reveal the first details of what will be one of the strangest ocean-going craft afloat. Measuring 1,016 feet long, it will rank in size with the biggest ships in the world. Strictly speaking, however, it may not be a ship at all, for Navy men incline toward a design that omits propelling machinery and calls for the gigantic hulk to be towed from place to place.

Designated as the *ARD-3*, the 45,000-ton monster will serve as a floating dry dock for warships. Since it will be big enough to accommodate the largest vessels in the U. S. Navy, it will permit repairs that otherwise could only be carried out at a distant navy yard. Even the mighty aircraft carriers *Lexington* and *Saratoga* can be hoisted high and dry with its aid. Its design marks a bold innovation in naval operations. A shiplike bow and steering

machinery permit it to travel through the water at ten-knot speed. The only floating dry dock of comparable size, attached to the great British naval base at Singapore, Straits Settlements, is not mobile. By contrast, the *ARD-3* will be able to follow the fleet wherever it may go, as an invaluable new member of the flotilla of auxiliary craft that keeps our ships of the line fit to fight.

A naval victory takes more than big guns.

Dry Docks

KEEP OUR NAVY
IN FIGHTING SHAPE

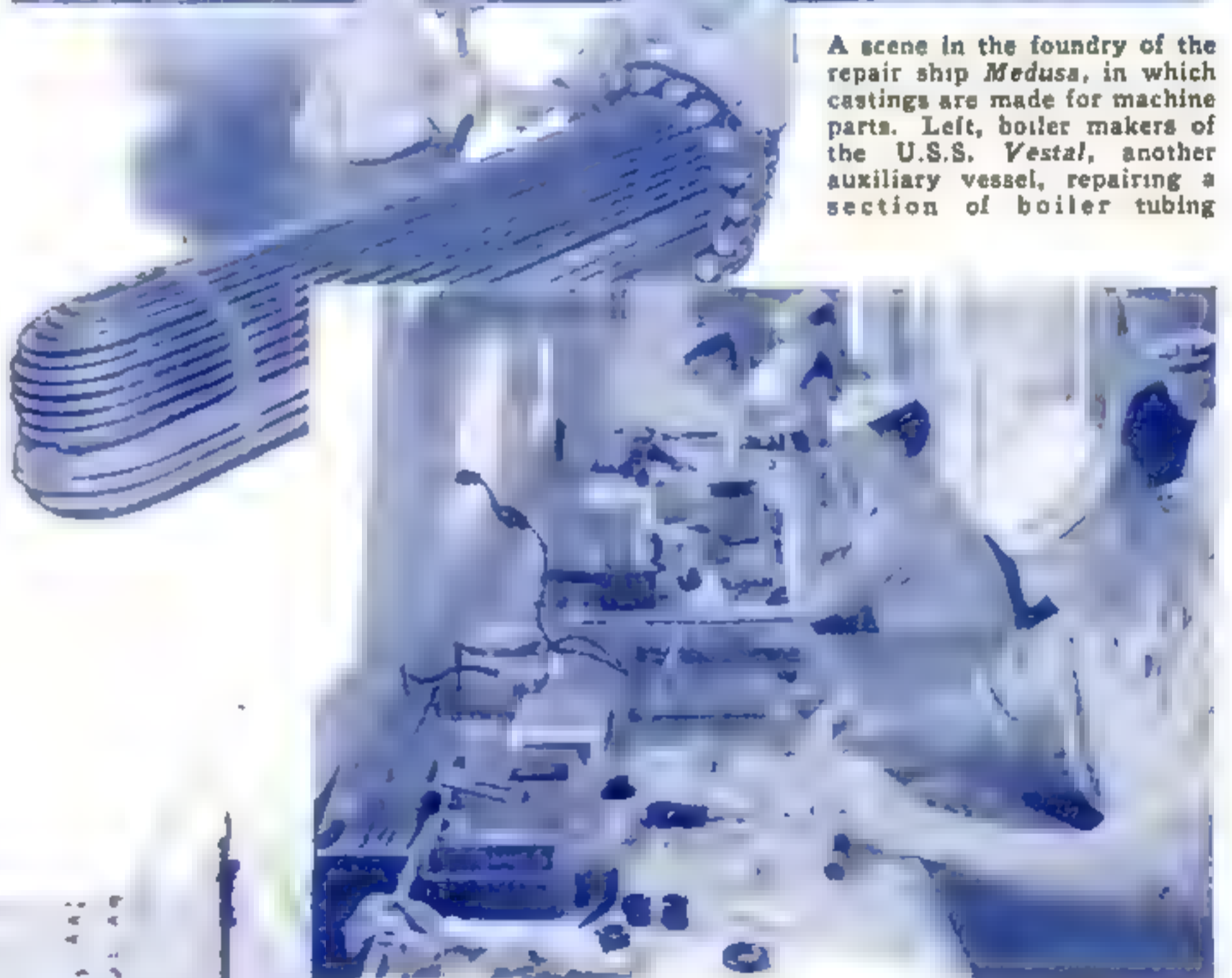
If the proud dreadnoughts of a fleet win an engagement, much of the credit must go to the humble tenders and repair ships that have kept them tuned to fighting pitch. In our own Navy, today, thirty-four auxiliaries make up this all-important Base Force. Attached to the destroyers and submarines of the fleet, to assure their mobility, are tenders capable of making repairs and transporting essential supplies. The two principal repair ships—the *Medusa* and the *Vestal*—perform the same service for our battleships and cruisers.

Veritable factories afloat, the foundries and machine shops of the repair ships can supply at short notice anything from a two-ounce filing-cabinet catch to three-ton piston rings for a battleship's main engines. In one recent week, 781 different jobs were under way in the *Medusa's* twenty-eight departments and shops as she lay within the breakwater at San Pedro, Calif., serving the needs of war craft anchored near-by. Skilled workmen aboard these ships can mend the broken spring of a stop watch, fix a faulty pair of binoculars, or restore a dreadnought to the battle line, if need be, in jig time after a boiler explosion has put it out of commission. If a vessel's hull is rent by a torpedo or a collision, they are prepared to patch it so that the ship can limp to port for more extensive repairs.

In time of war, however, a long trip to a coastal base may withdraw a warship from service just when it is most needed. Hence the Navy has developed its pioneer idea of sending floating dry docks along with the fleet so that even major repairs can be made on the spot. A small mobile dry dock, the *ARD-1*, is already in commission as the experimental prototype of the new auxiliaries. Bids have been asked for a sister "ship," the 446-foot *ARD-2*. These two floating dry docks will be able to service destroyers and submarines. Now the Navy plans its monster *ARD-3*, authorized by the last Congress, to take care of the biggest ships of all—in any harbor deep enough to float it. Its estimated cost of \$15,000,000, twice that of a stationary dock, is expected to be amply repaid by its strategic value.



A scene in the foundry of the repair ship *Medusa*, in which castings are made for machine parts. Left, boiler makers of the U.S.S. *Vestal*, another auxiliary vessel, repairing a section of boiler tubing



Optical workers on a repair ship putting officers' telescopes into first-class condition. The auxiliary vessels are prepared to fix anything from a watch to a steam engine



The U.S.S. *Medusa*, repair ship to the Battle Force, following the fighting ships in maneuvers on the Pacific. The seagoing dry docks will supplement the vital aid given our warships by vessels like this

FOLDING SHIELD FOILS BANK BANDITS



Concealed in the counter, this bulletproof shield unfolds at a touch

FOLDED compactly into a bank or store counter, a collapsible shield opens to form a bulletproof barricade against bandits. The unit is made of six steel sections, held together with spring hinges. If a bandit holds up a clerk, the latter kicks a concealed lever, and the shield springs up out of the counter. Thus protected, the clerk can point his gun through a hole in the shield and look through a viewing slot to aim. When folded, the shield is not in the way of the clerk.



TORCH FOR WELDING HAS PREHEATING FLAME

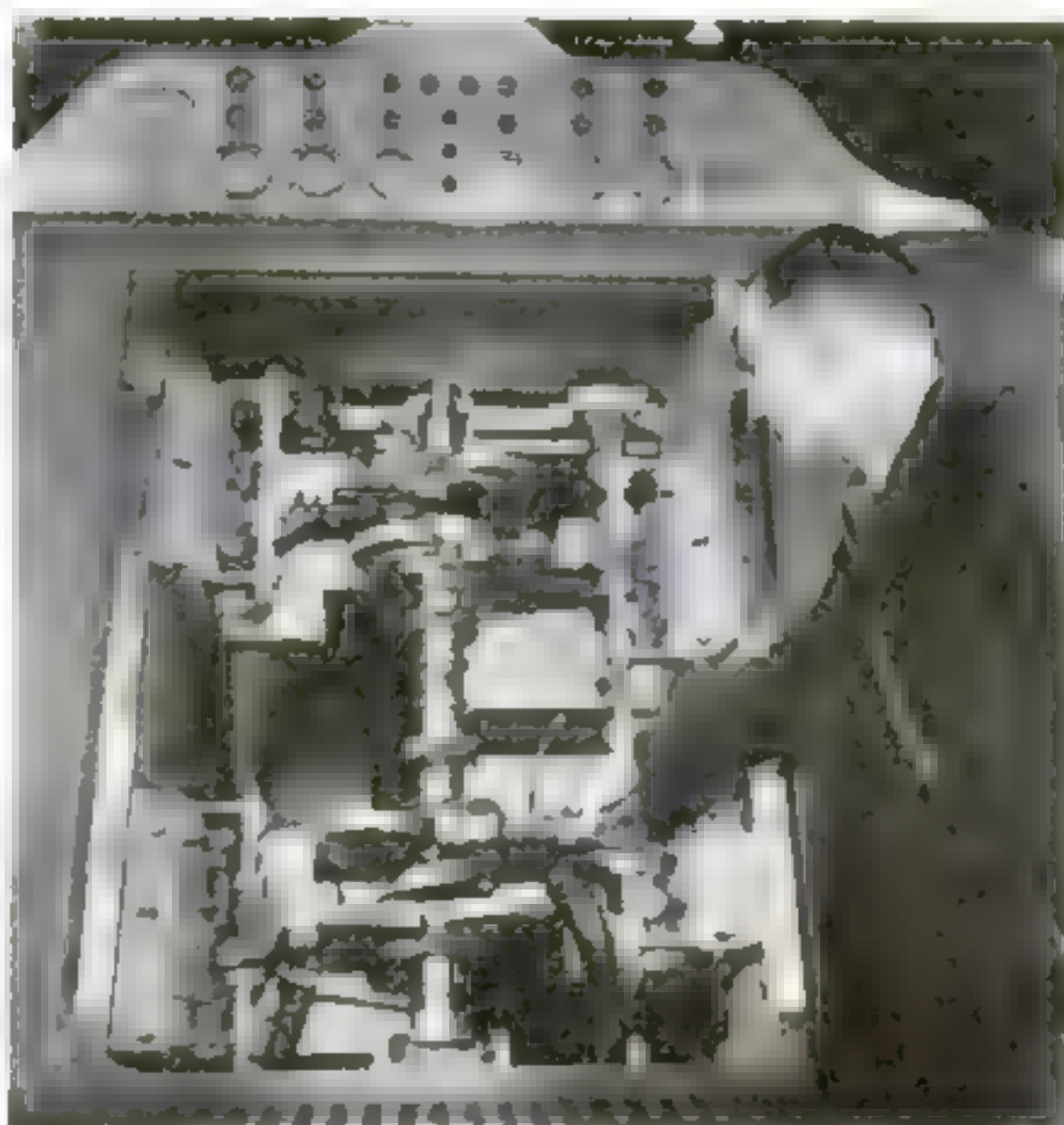
SINCE metal surfaces must be heated before they are welded together, a new oxyacetylene torch that directs a preheating flame in front of the welding flame is expected to simplify the welding process. In the illustration above, the welding flame, right, is fusing a pipe joint, while a second smaller flame, left, is preheating the joint surfaces about to be welded. The new torch is said to weld a seven-inch pipe in seven minutes.

FILTERS FOR SEA WATER

OCEAN WATER is made potable by two filters of synthetic resin recently developed. Salt water taken from the sea is passed first through one and then the other of the two resinous filters, after which it emerges as water that is suitable for human consumption.

ELECTRIC CURRENT QUICKLY HARDENS CAR CRANKSHAFTS

CRANKSHAFTS used in automobiles, trucks, tractors, and heavy machinery are quickly hardened after manufacture by an ingenious electrical machine just developed. Shaft parts are placed in the device and surrounded by special "inductor blocks." An electric current of low voltage and high amperage passing through the blocks induces a heating current in the shaft surface and hardens the metal. The machine is expected to reduce the cost of the necessary hardening process, since the electrical method takes only two minutes, whereas the usual procedure of baking in a furnace requires five hours.



A crankshaft in an electrical machine that hardens metal

MOTOR LIFTS CRIPPLE OUT OF HIS CHAIR

DEvised by a crippled inventor, an ingenious chair has a hinged seat that helps a crippled person to get to his feet. The base of the chair houses an electric motor which is geared to the seat; at the touch of a button, the motor tilts the seat cushion forward from a horizontal to a vertical position, gently pushing the chair's occupant from a sitting to a standing posture without effort on his part. A small mat in front of the chair prevents his feet from slipping out from under him while he is being helped up. Such chairs are expected to be helpful to infantile-paralysis victims.



HINGED RULER GAUGES ANGLES BY MEANS OF SPECIAL SCALE

ANY desired angle can be formed with a jointed two-foot ruler recently marketed. To set the ruler at a seventy-degree angle, for example, a pair of dividers is placed along special markings on one leg of the ruler, and opened until it spans seventy units on the scale. The legs of the rule are then spread apart until the dividers span exactly the distance between two "center dots" etched on the ruler legs, as shown above, when they form the angle desired. By reversing the process, unknown angles can be measured quickly. Thus, mechanics need not carry a separate protractor.

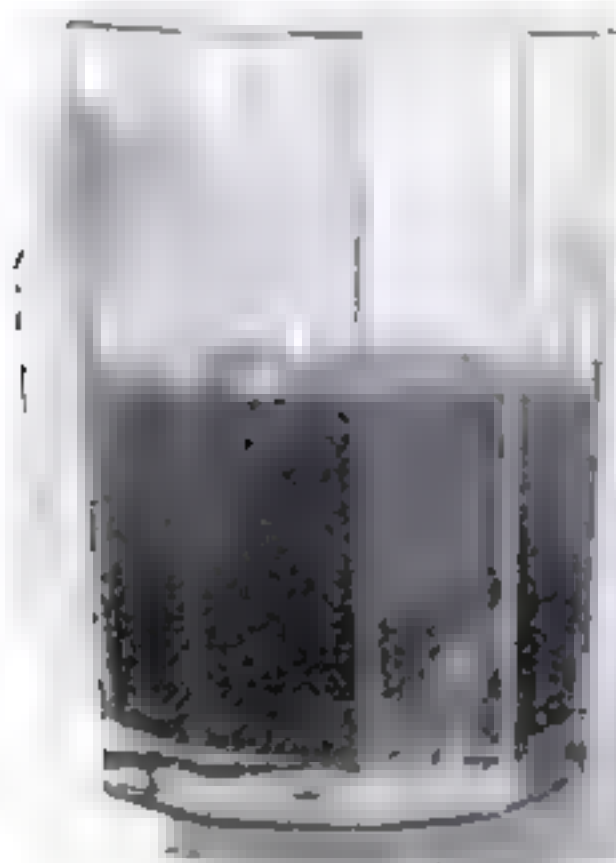


Tank Truck Fights Fire with Wall of Water

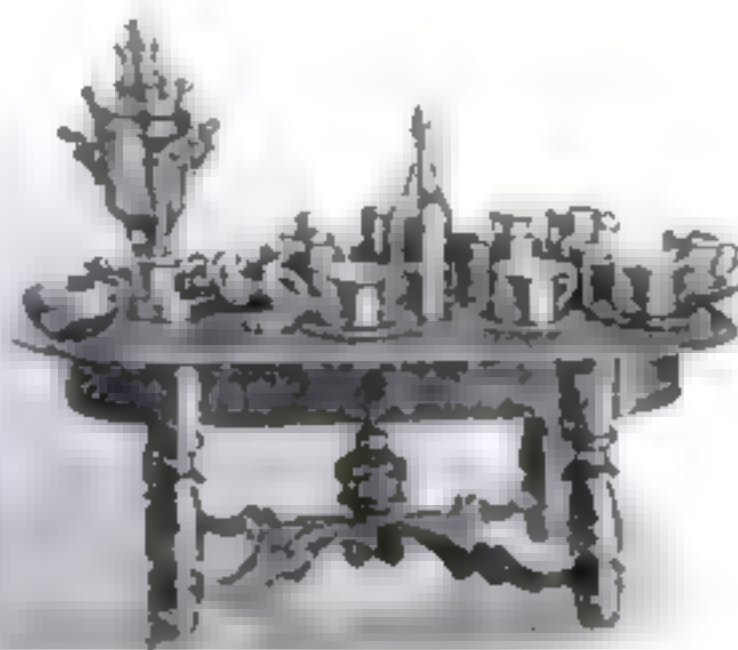
SHOOTING powerful sprays of water from special jets, a novel machine recently tested in England is a new aid to fire-fighting. The apparatus consists of a three-wheeled truck which draws a trailer tank having a water capacity of 1,200 gallons. In addition to numerous adjustable spraying jets, the portable tank carries lengths of hose on reels mounted over the rear fenders. Backed against the side of a burning building, the machine drenches the surface with a wall of water. In certain cases, the apparatus can be backed through a doorway directly into a blazing structure to radiate sheets of water in all directions. Another suggested use for the apparatus is for extinguishing oil fires. When not needed as a fire-fighting unit, the tank will be used for street cleaning. In case of a wartime gas attack, the machine can be adapted to spray streets and buildings with chemical solutions designed to counteract the poisonous effects of the gas.



New British fire-fighting machine in a demonstration of its possible use for spraying chemicals to counteract poison gas. Jets at the rear of the tank trailer throw up a veritable wall of water to put out fires



SILVER TEA SET WEIGHS AN OUNCE



The diminutive tea service compared for size with an ordinary water glass. It rests on a tiny table made of German silver

MADE by a Russian jeweler, a miniature silver tea service is dwarfed by an ordinary water glass. Complete with cups, saucers, samovar, sugar bowl, and bottle for hot water, the tiny set weighs less than one ounce. The silver service is gilded, and is shown displayed on a diminutive tea table. The table is made from German silver, and its spindle legs are turned in elaborate fashion.



ASH TRAY DUMPS BUTTS WHEN IT IS LIFTED

ASHES and cigarette ends are dumped into the interior of a novel chromium ash tray whenever it is lifted off a desk or table. As illustrated in the diagram above, a curved valve head is supported by a metal stem and drops into the position indicated by the dotted lines when the receptacle is picked up. The top rim is easily removed whenever it is desired to clean or empty the ash receiver.

CARTON IS DISPENSER FOR GUMMED LABELS



A spring inside the container feeds a label to the top, where it is removed easily

GUMMED labels or paper hinges are now housed in a convenient new dispensing carton. A small spring inside the container presses the contents upward, and a single label or hinge may be obtained by passing a finger across the opened top of the box. Designed to prevent curling, the container also keeps gummed papers from sticking together.

SPIKED BOARDS DISCOURAGE PIGEONS



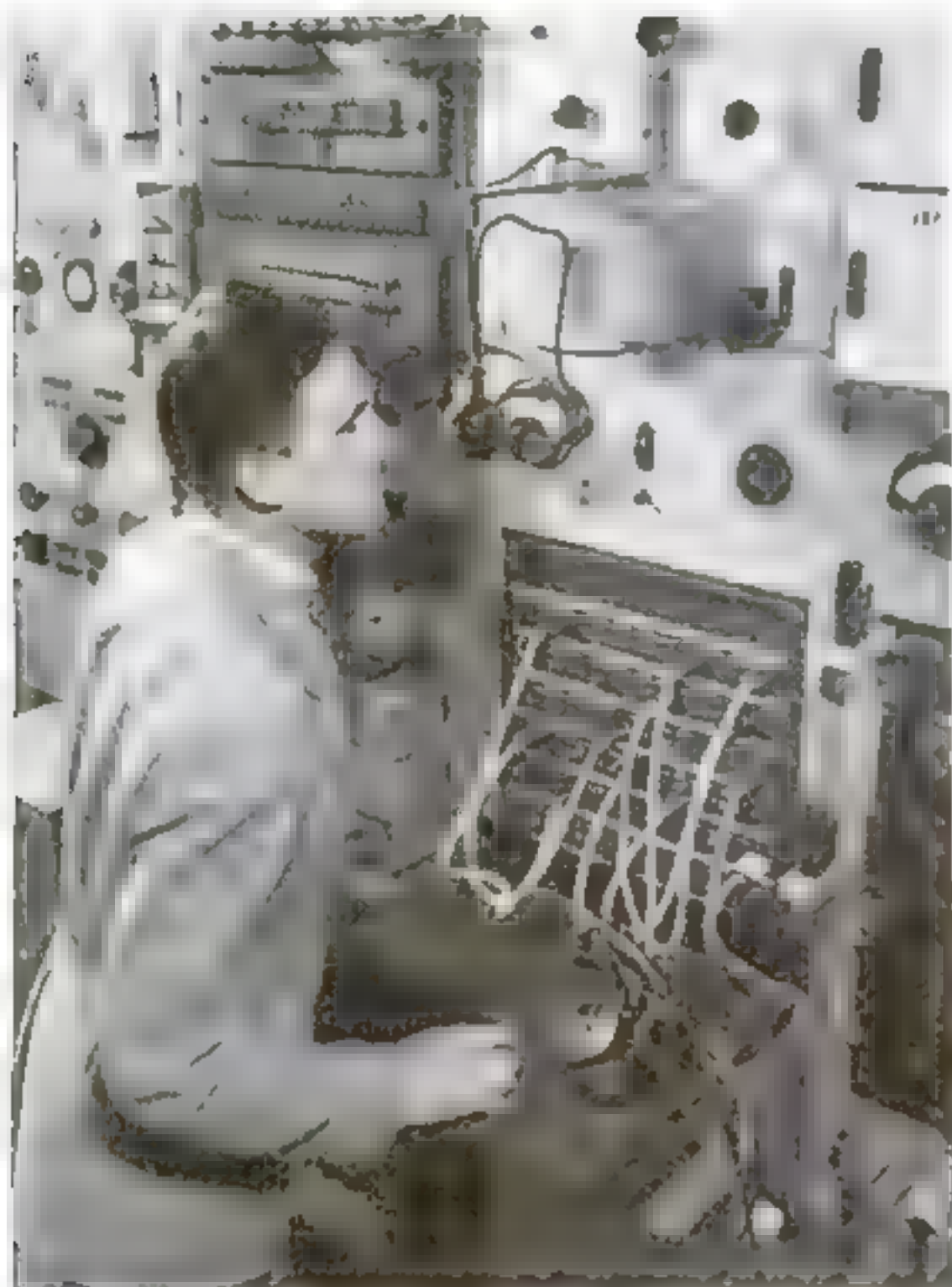
Spikes keep pigeons off the U. S. Treasury building

TO PREVENT pigeons from roosting on cornices on the U. S. Treasury Building in Washington, D.C., Government officials adopted the novel anti-pigeon boards shown in the photograph at the left. Planks containing thousands of long upright nails placed close together were fastened to projecting ledges to prick the feet of alighting birds and prevent them from using these spots for perches or nesting places.

AUTOMATIC GAS PUMP

MOTORISTS may soon serve themselves at an automatic filling station devised by an Arkansas inventor. The driver would stop at a pump, stick the hose nozzle into his car's tank, then pay for the desired number of gallons at a central cashier's booth. By operating levers on a control board, the cashier starts an automatic mechanism that pumps the right amount of fuel to the automobile.

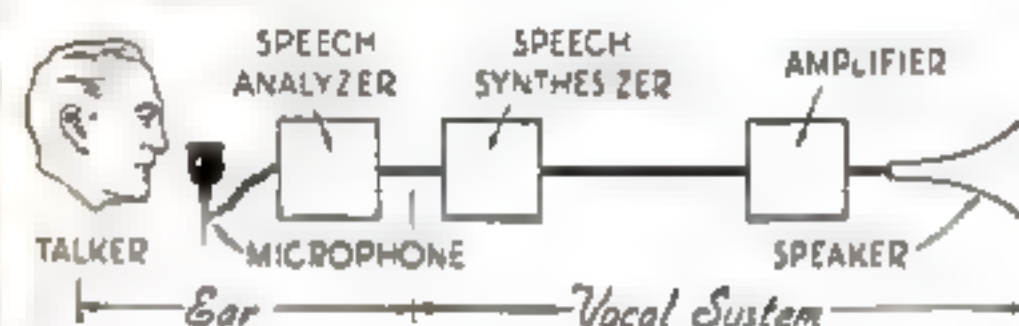
ODD ELECTRICAL DEVICE "MANUFACTURES" HUMAN SPEECH



An engineer talking into the microphone of the speech-synthesizing apparatus. Drawings show how it works

BY COMBINING artificial sounds electrically, engineers of the Bell Telephone Laboratories in New York City have produced an almost exact imitation of the human voice. The feat is performed with the aid of an elaborate electrical hook-up, originally designed for a study of the mechanism and nature of speech. When a person talks into the device, it breaks down his tones into their component parts. These are made to control currents flowing from storage batteries into parts of the "speech synthesizer" that automatically

mimic each component. The reproduced sounds are then blended and heard through a loudspeaker. Since the reproduction process is more or less independent of the actuating human voice, the apparatus may be set to alter characteristics such as pitch and loudness. Thus it can be made to accompany a singer with a voice of different pitch, in almost perfect harmony, enabling him to sing a duet with himself! Experimenters with the apparatus compare its batteries to human lungs, its vibration-producing elements to vocal cords, and its tuned electrical circuits to the resonating air chambers in the mouth and nasal passages. One of the results of the experiments conducted with the aid of the speech synthesizer has been the discovery that ordinary human speech consists essentially of two distinct tones, neither one musical nor melodious, but each possessing a characteristic pitch and loudness. When these are blended, the sound of a human voice is heard.



TOY RAILWAY CARRIES MESSAGES IN STORE

A TWO-CAR toy electric train hauls shipping orders, invoices, and messages for a San Francisco, Calif., wholesale florist. Running on an elevated track 130 feet long and with a fifteen-percent grade, the train connects the firm's offices on a mezzanine with the shipping department on the first floor. Orders and notes are stacked in the open-top cars, which start at the touch of a button and stop automatically at the other end of the line. Other firms are said to be considering the use of similar train outfits.



PENCIL HAS SIX COLORS

Six colored leads are molded together in the pencil shown below. When held properly, the pencil will write in any one of the colors.



SINGLE SPOKE SUPPORTS CAR'S STEERING WHEEL

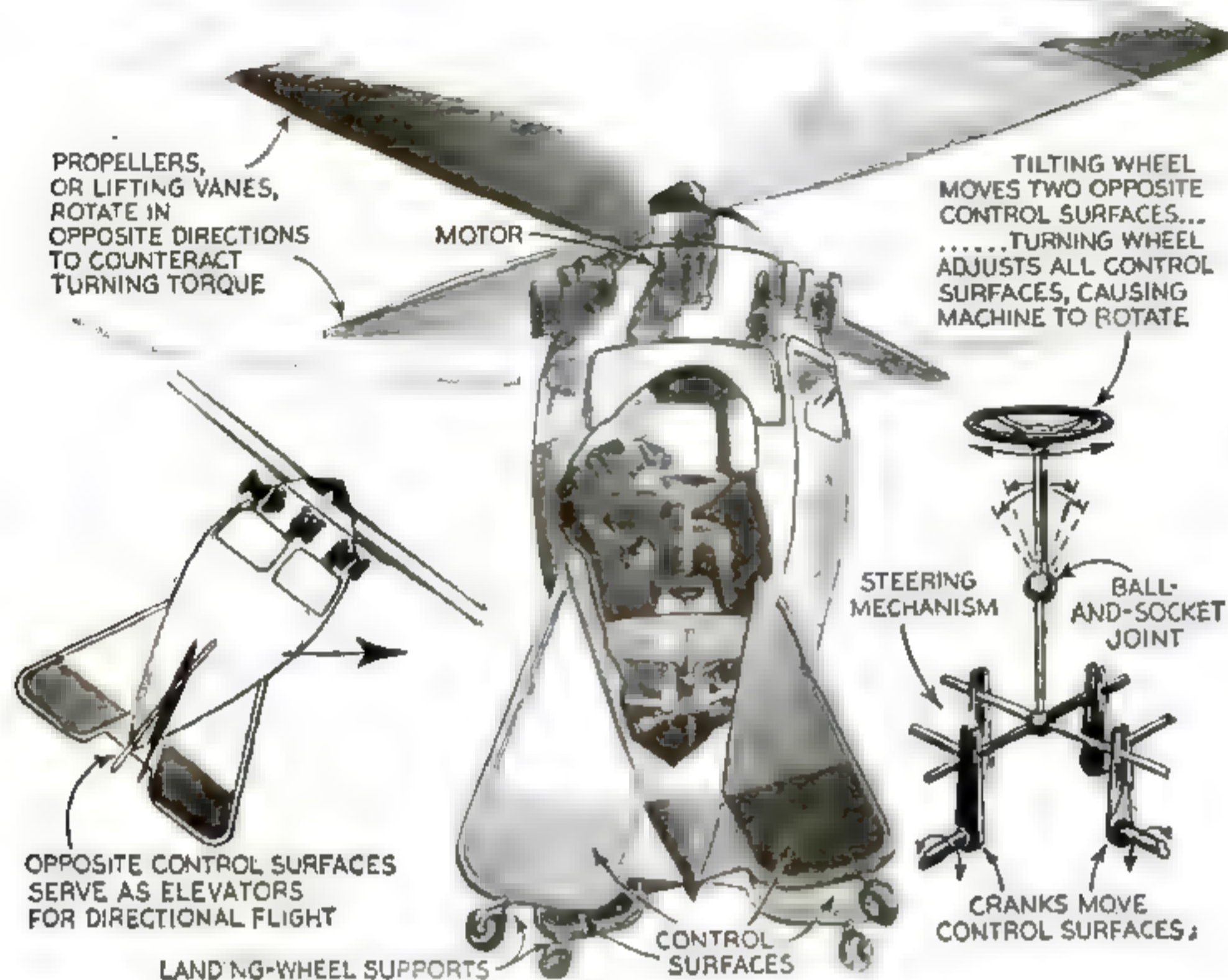
MADE of a strong steel alloy, a flexible automobile steering wheel with only one supporting spoke is said to eliminate the vibration often found in rigid wheels. The novel wheel is wired so that it can be warmed electrically in winter, and contains a built-in self-winding clock.

TRAILER BED CONCEALS BUILT-IN TUB

A BUILT-IN bathtub forms an added convenience in a new automobile trailer just placed on the market. Housed within the solid base of one of the trailer day beds, the tub is filled with water by means of handpumps that tap the trailer supply tank. When it is not being used, the bathtub is completely hidden from view by the easily removed frame and mattress of the day bed. The photograph shows how it appears when in use.



NEW HELICOPTER RESEMBLES A ROCKET



Novel helicopter as it would appear in flight. With the single, steering-wheel control, the operator can vary the angle of ascent, and turn the body of the craft to face in any desired direction

DESIGNED to shoot vertically into the sky like an inverted aerial bomb, a novel helicopter devised by an Indiana inventor will have huge twin propellers spinning in opposite directions at its pointed nose. This feature overcomes the torque, or twisting effect, of a single propeller turning at high speed. Four pneumatic caster wheels, attached to steel brackets that flare out from the sides of the new helicopter, will form the landing gear. Within these brackets will be the stabilizers and

rudders operated from the cockpit by means of a wheel mounted on a ball-and-socket joint. If the pilot tilts the wheel forward or backward, the control fins will cause the machine to veer away from its vertical flight. If he turns the wheel, the control surfaces will rotate the fuselage, thus enabling the pilot to face in any desired direction. A single radial engine, mounted at the top of the helicopter, will drive the two propellers through a system of gears.

TEST HANDS FOR CAUSE OF STUTTERING

BECAUSE "wrong-handedness" can cause stuttering, experts now determine whether a stutterer is normally right- or left-handed. Blindfolded, the subject traces designs on paper, and follows a curving pattern cut

out of wood, while examiners note the comparative ability of each hand. When a stuttering person is found habitually using the wrong hand, a permanent switch to the other hand often clears up his speech defect.



A sufferer from stuttering receiving a test to determine whether he habitually uses the wrong hand



MACHINE APPLIES SUDS TO CLEAN UPHOLSTERY

UPHOLSTERED furniture is quickly dry-cleaned with an electric machine recently marketed. Dry, air-blown suds are pumped through a hose to a motor-driven brush unit which coats and massages the fabric with the chemical cleanser. A second hose unit sucks the dirt-laden suds back into a refuse tank, leaving the fabric thoroughly cleansed. In the photo above, suds are being brushed on a divan, while the inset shows how the suds are removed.



The broad, flat flukes of this lightweight anchor give it remarkable holding ability. At left, how it is folded for easy storage



YACHTS AND SEAPLANES GET NEW, LIGHT ANCHOR

WEIGHING only twenty-five pounds, a lightweight anchor of special design has just been perfected for mooring yachts and seaplanes. Pound for pound, the new anchor is said to have more than twenty times the holding power of heavy naval types now in use. When the anchor is dropped, its flat, pointed flukes burrow into the ocean floor, yet can be easily raised by a direct pull from above. Flukes and stock arms of the anchor fold back for convenience in storing in a limited space.

Tom Thumb Chemistry

A vest-pocket laboratory: equipment used in making microchemical tests

SOLVES PROBLEMS OF SCIENCE AND INDUSTRY



This laboratory worker is performing a delicate operation under the microscope. He handles the material with a "micromanipulator" and watches an enlarged image on a screen

YOU have heard a lot about miniature cameras in the past few years, but did you know that a miniature-chemistry boom is in progress in this country? If you didn't, probably it is because chemists call it microchemistry, and because the "boom" is not one that the man in the street would be likely to notice. Maybe the chemists do not think of the growth of microchemistry as a boom, but nevertheless the midget laboratory is being adopted at a surprising rate by research institutions, industrial organizations, and others who use chemical analysis.

Microchemistry is to normal chemistry what the microscope is to ordinary sight. It enables chemists to handle, identify, and measure quantities of chemical substances too small to be worked with in conventional ways. The microchemist deals ordinarily with quantities of materials weighing from one to ten milligrams. A milligram is one thousandth of a gram; and a gram is equivalent to about one twenty-eighth of an ounce avoirdupois.

Why trouble with such small quantities? A glance at a few of the applications of microchemistry gives the answer.

A baby lies desperately ill in a hospital. To diagnose

the ailment, it is vitally necessary to analyze the infant's blood for sugar, nitrogen, urea, and other things it may contain. But withdrawing the amount of blood required for analysis by standard chemical methods may prove fatal to so small a child. Microchemistry comes to the rescue. Through its incredibly delicate methods, a single drop of blood tells the story the doctors are waiting to hear, and a life is saved.

Detecting signs of arson, and distinguishing between genuine and fake fingerprints, where the scientific detective has no more than a mite of material to work with, are recent applications of microchemistry. In murder cases, microchemists discover traces of poison too minute to be found by any other method.

Exposing forgeries in paintings and antiques gives microchemistry a task for which it is particularly suited, but that is not its only application in the field of art. With its aid, the painting materials used by the old masters can be identified and the technique used by ancient craftsmen can be revealed. When archaeologists discovered exquisite mosaics of rainbow-hued glass within a galley of the ancient Roman Emperor Caligula, brought to light by draining the waters of Lake Nemi in Italy, microchemists were able to establish that all the colored pieces of glass had come from a single Roman factory. Moreover, they contributed the information that modern pigments of cobalt and chromium were unknown to the Romans, since the blue glass contained no cobalt nor was chromium found in the green varieties.

What is the air like, a dozen miles or more above the earth? Men in balloons can bring back big bottle-fuls of the upper air for analysis, but such ascensions



A TYPICAL MICROCHEMICAL TEST

To analyze the metal in the contact point of an electric relay, a tiny sample is obtained by scraping with the roughened end of a narrow glass slide. The slide is put in a small flask where acid fumes react with the metal to form a salt for the test

Using Thimble-Size Crucibles, Flasks, and Beakers, Research Workers Make Analytical Tests Of the Most Amazing Accuracy In Lilliputian Laboratories

By JOHN E. LODGE

are hazardous and costly. Now, British experimenters are sending up small unmanned balloons, bearing tiny evacuated glass vials no larger than medicine droppers. Automatically opened at a predetermined height, and closed again after fifteen seconds, they bring back air samples in which microchemical methods can measure the quantity of gases as rare as helium within an accuracy of one percent.

To handle and analyze such specks of matter, the microchemist employs a vest-pocket laboratory. His midget beakers, crucibles, and test tubes, compared with standard chemical ware, look as if they might have been designed for a Lilliputian scientist.

A Bunsen burner no bigger than a pocket cigarette lighter produces a blue flame barely an eighth of an inch high, to heat test tubes a fiftieth of an inch in diameter. To fill the tubes, they are merely touched to a liquid, and suck it up by capillary action. "Microbeakers" are of thimble size. Chemical manipulations on such a Tom Thumb scale require ingenious expedients; to stir a solution, for example, a glass ball containing iron powder is dropped in the liquid and jiggled with a magnet! It is not stretching the truth much to say that the microchemist can hold a complete laboratory in the palm of his hand. That is, all except his microbalance.

Large when compared with most of the midget equipment, the microbalance is apt to occupy the most prominent position in the laboratory—and deservedly, for it is the heart of the place. Its name does not come from its dimensions but from its sensitiveness. A human hair tips the beam of a standard chemical balance, but this is not nearly delicate enough for microchemical work. So the knife edges of a balance beam are ground with greater precision, and the agate bearings upon which they rest are adjusted with greater nicety, until the balance can

A worker at the research laboratory of the General Electric Company working at the microscope, surrounded by the Lilliputian tools of the microscopist's art



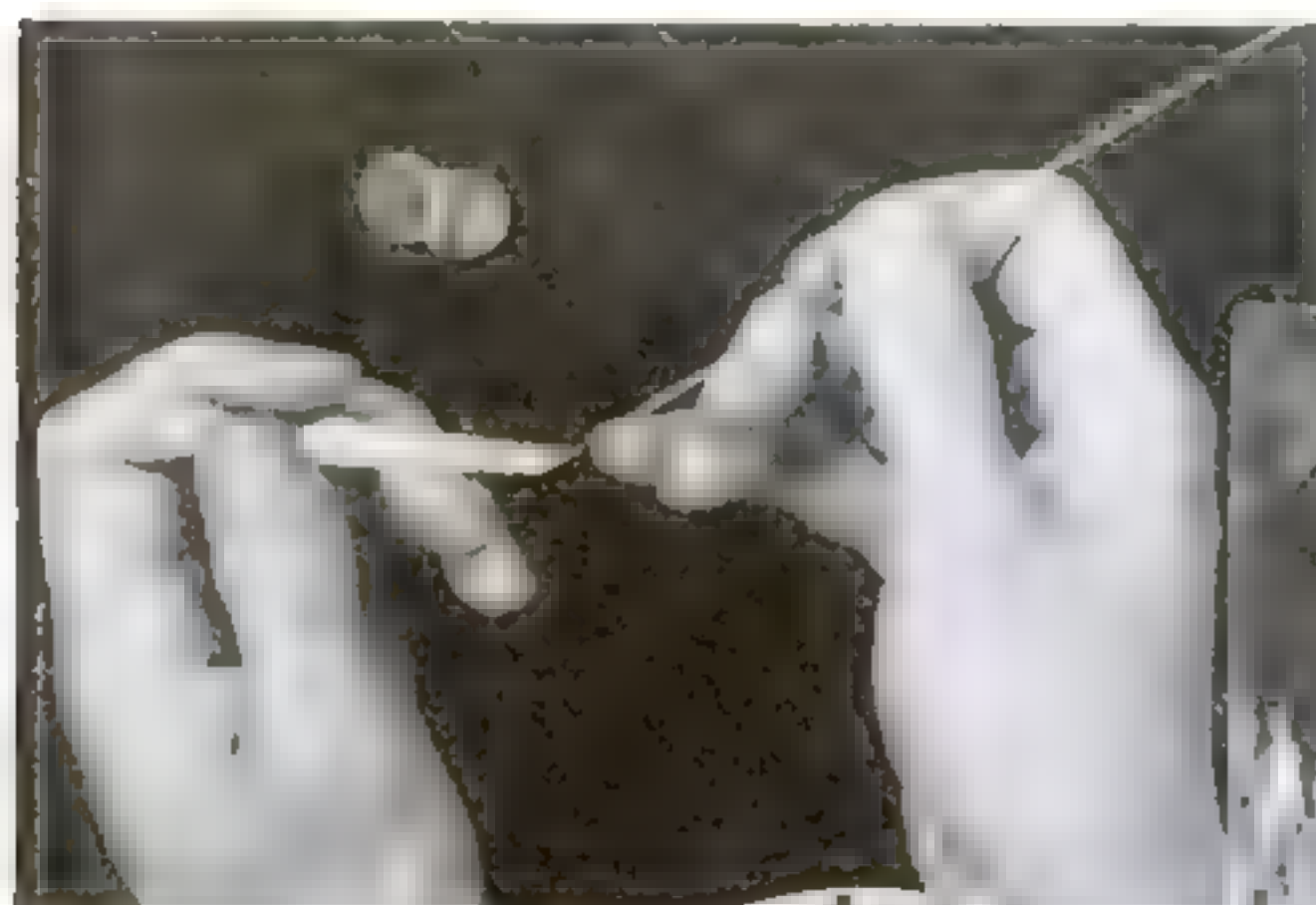
weigh a particle of matter nearly too small for the human mind to conceive—a millionth of a gram! Divide a pound of butter into sixteen parts, and one of those parts into twenty-eight smaller pieces. Then cut one of the pieces into 1,000,000 particles, and each of the tiny particles will represent approximately the smallest quantity the microbalance can weigh.

This miniature apparatus, and ways of using it, were not developed overnight. Microchemistry first appeared as a promising science back in 1910 when an Austrian scientist named Fritz Pregl set out to study the acids in bile, the stuff that your liver manufactures. After he had put a ton or so of bile through elaborate and time-consuming processes, he found himself with only two or three crystals of a product he wanted to analyze. Ordinary chemical tests—chemists say "macrochemical" to distinguish them from "microchemical"—were useless. So he found that he would have to convert several more tons of bile, or invent a new chemical technique. He chose the latter course. Awarded the Nobel Prize for his achievement, he gave miniature chemistry its start. Others adapted and refined his methods to apply the new science in every branch of chemical research—not only to solve biological and medical problems, but industrial ones as well.

To see midget chemistry in action, let's visit the Bell Telephone Laboratories building in New York City, where Dr. Beverly L. Clarke presides over one of the country's foremost microchemical

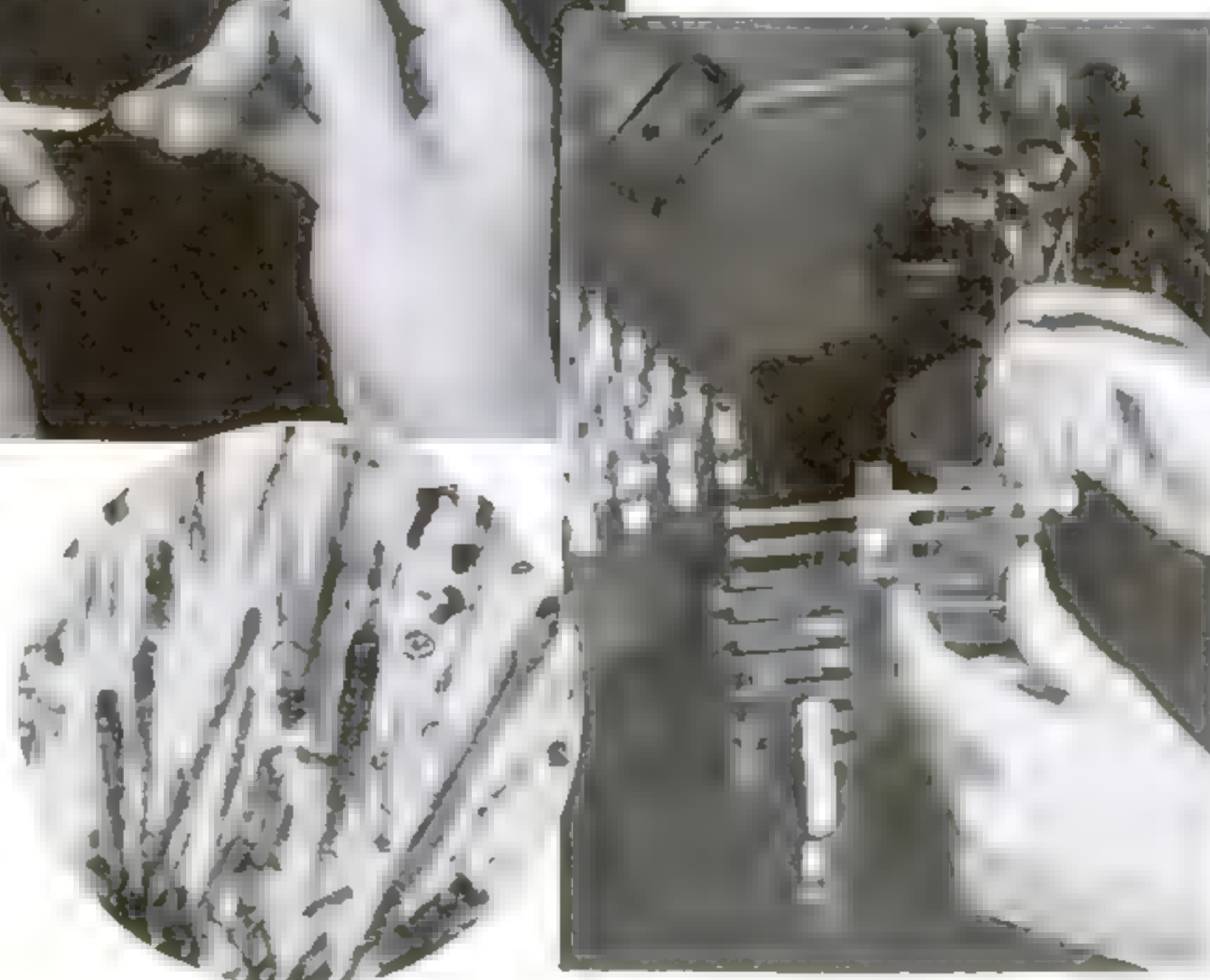
laboratories. Little larger than an ordinary living room, it presents the appearance of a chemical "doll house." Vest-pocket vials of reagents in wooden blocks replace rows of big bottles lining shelves. Flash-light cells run a device to treat liquids with electricity. All the air that enters the room passes through a filter to remove any specks of dust that might ruin an experiment.

Someone brings in a telephone contact point for analysis. Switches and relays employ the tiny points to open and close electric circuits, and they are made of a variety of metals and alloys. Perhaps this one is the product of another firm; perhaps it is the company's own make, but there are no records of its composition to check with its observed performance in service. The microchemical laboratory's task is to find out what it is made of—and do it without damaging the sample, which is (Continued on page 126)



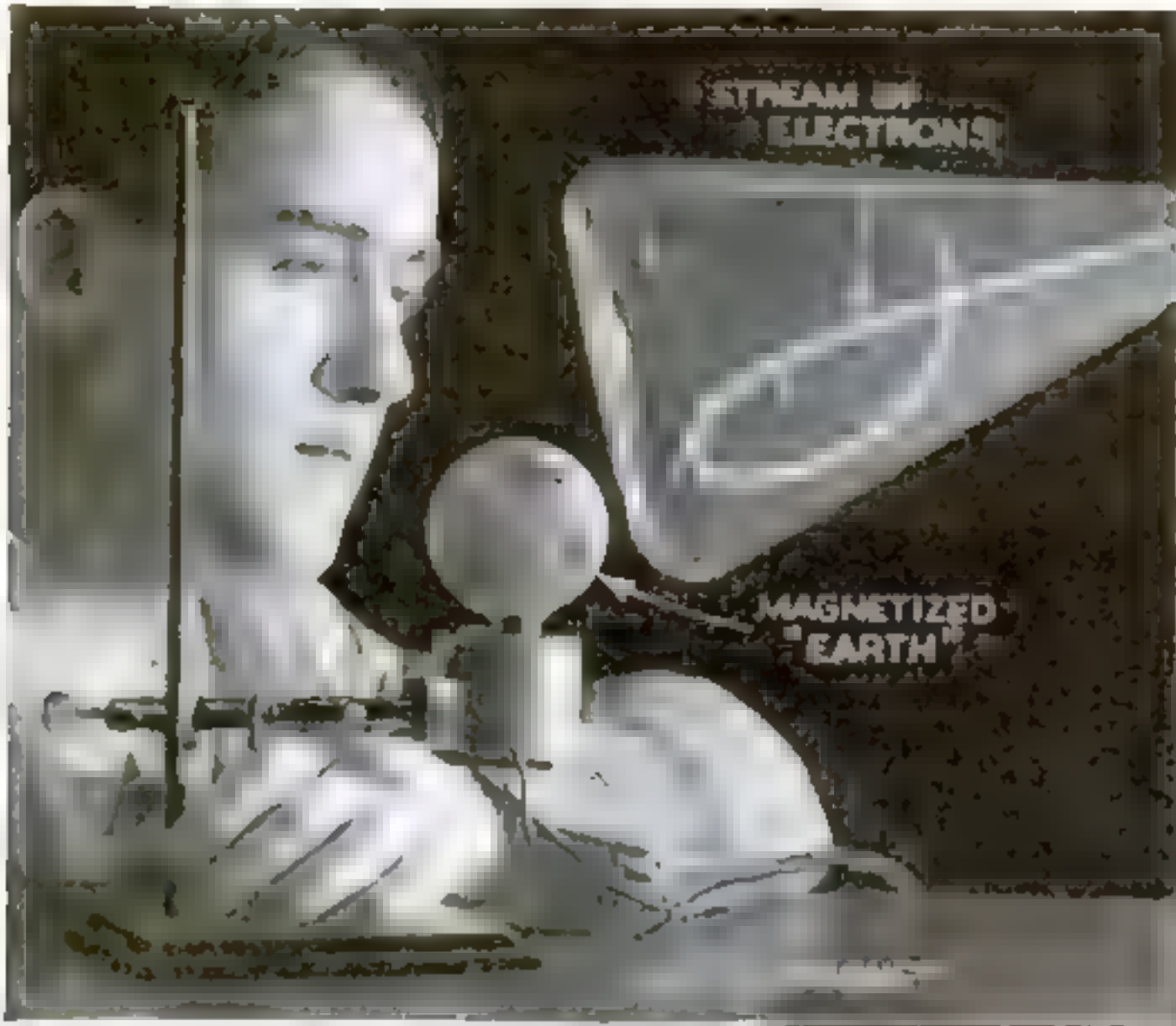
Reagents are applied to tiny samples, and the resulting solutions removed, with threadlike capillary tubes like this one

Instead of watching a reaction in full size, the microchemist puts a tiny drop on a slide and examines the resulting crystals under the microscope lens



Tiny Miniature Earth Offers a Solution to a Mystery

What Makes The Northern Lights?



The theory that the flaming banners of the northern lights are caused by the effect of the earth's magnetism on streams of electrons from the sun, can be demonstrated with a magnetized metal globe and a cathode-ray oscillograph, as shown at left

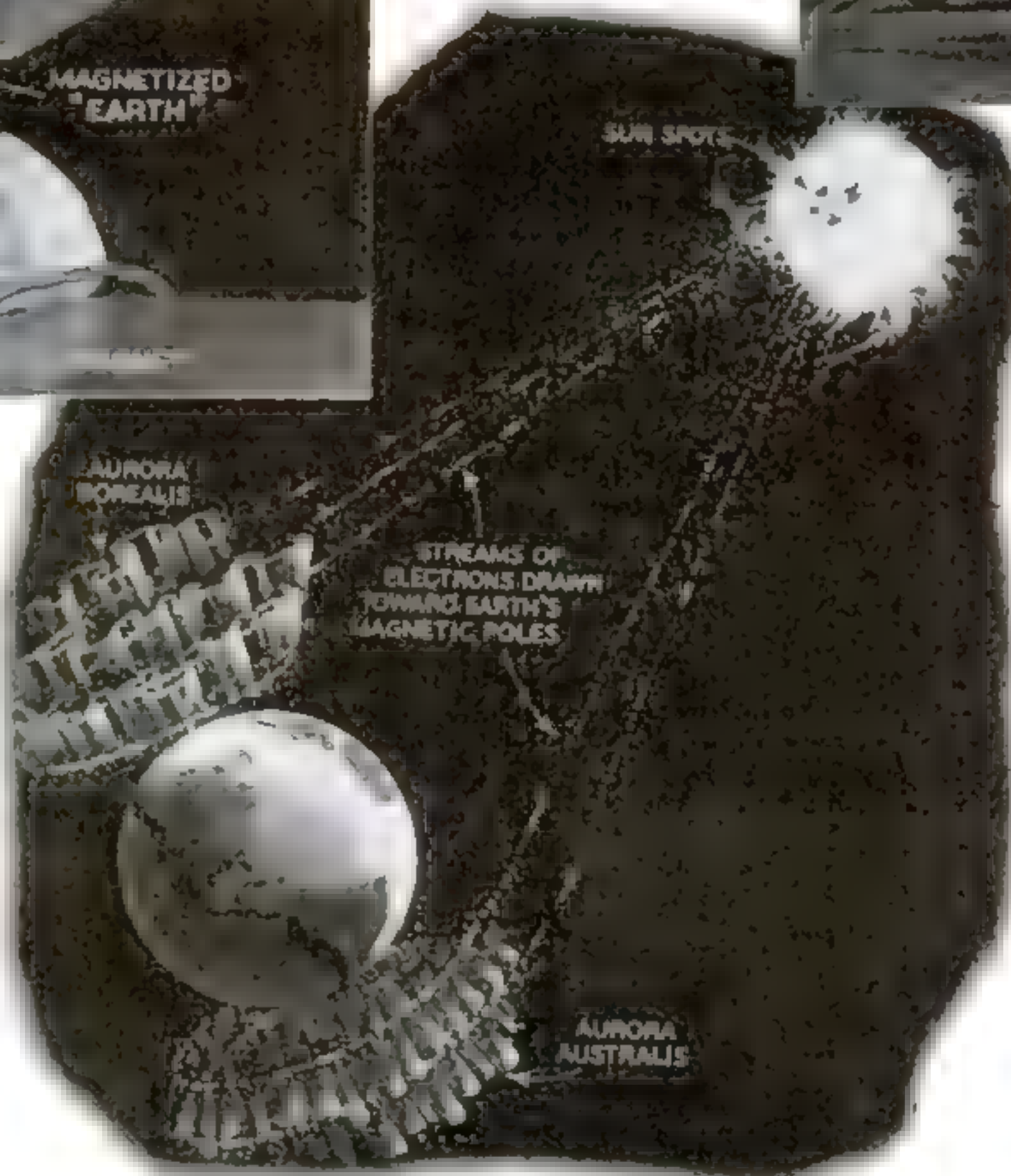


By
**GAYLORD
JOHNSON**

AT LAST, the mysterious "northern lights," or aurora borealis, has yielded up its secret. And, strange as it may seem, the force which produces these enormous colored displays in the northern skies is the same that forms the brilliant red, blue, or green glow in neon advertising signs. According to the generally accepted theory, every time you look at the glowing thread in the familiar glass-tube signs, you are seeing the same kind of electric bombardment that sends up the great glowing streamers that we call the northern lights.

In a neon tube, tiny particles of electricity, known as "electrons," are shot off from a terminal at one end of the lamp and bombard the gas molecules, causing them to glow brightly. In the aurora borealis, the glowing streamers are produced through a similar action in which the electrons are shot from the stormy electrical areas, or "sun spots," on the sun, while the rarefied air surrounding the earth acts just as the gas in the neon tube.

If the earth were not a magnet, with north and south magnetic poles, the aurora might be produced and seen at all latitudes, instead of mainly in the arctic and antarctic zones. But since it is a magnet, its north and south magnetic



Electron streams emanating from sun spots are deflected to the north and south magnetic poles of the earth, producing the two auroras

fields draw the sun's barrage into two sets of streams which swirl, one into the extreme northern air, and the other into the far southern atmosphere.

This twisting of electron streams into curved and spiral paths can be illustrated, as shown in the photograph above, with a miniature magnetized "world" in any electrical laboratory which possesses a cathode-ray oscillograph. To simulate the magnetized earth in miniature, a small hollow tin globe was placed on the iron core of an electromagnet. It was, of course, attracted strongly and became magnetized. As this little globe was brought close to

the screen of the tube, the glowing electron beam, which ordinarily is straight, was bent. Each time the magnetized earth was shifted, the beam of electrons spiralled into a new curve; changing shape as rapidly as the real aurora borealis does in the northern skies.

It is interesting to note the enormous height above the earth's surface at which the electron bombardment of the air gives rise to auroral streamers. These heights have been determined accurately by Prof. Carl Störmer, a Norwegian scientist, who has repeatedly photographed auroral displays from two widely separated stations connected by telephone. When simultaneous pictures are taken from two towns, say fifty miles apart, the stars seen

through the streamers appear in slightly different places in relation to the streamers of light. Calculating the height of the streamers by ordinary surveying methods, the aurora is found to be from fifty to 500 miles above the ground!

At first glance, there would seem to be little similarity between the aurora borealis and ordinary summer lightning. Yet the forces that produce them differ mainly because of the strata in which they act. The brilliant lightning flash that strikes a tree is the path of negative electricity escaping downward into the earth, while the aurora is the glowing path of a "brush discharge" escaping upward. Scientists say it is fortunate that the aurora is found only high in the air. Otherwise the terrific electronic activity might wipe out all earthly life!

Radio Clinic Saves Lives at Sea



Received November 13, 1936, 11:40 A.M.
RADIO MARINE
 From the S/S "EASTERN STAR".
 HAVE MAN MEMBER OF CREW WITH PAIN IN ABDOMEN
 VOMITING BOWELS CONSTIPATED ABDOMEN RIGID NAUSEATED AND
 RESPIRATION 18 TEMPERATURE 98.3 PULSE 78
 CASTOR OIL PLEASE ADVISE FURTHER TREATMENT.
 (Signed) MASTER

An operator at a commercial radio station picks up a call from a ship, describing the condition of a sick seaman. He relays the message by phone to a marine hospital doctor, who prescribes treatment.



WHEN the radio call "MEDICO" crackles through the ether from a ship at sea, every transmitter within range shuts down. Taking precedence over everything but an "SOS," the emergency signal means that aboard a ship somewhere on the ocean a seaman is gravely ill, and that there is no doctor at hand to treat him. Through the aid of a modern radio service, the master of the vessel can get expert professional advice in a jiffy from physicians hundreds of miles away.

A flash describing the sailor's condition, with only the word "medico" for an address, gets instant action. Picked up by one of the commercial radio stations that handle shipping messages, it is telephoned at once to the nearest U. S. Public Health Service marine hospital. Doctors swiftly interpret the symptoms, diagnose the ailment, prescribe treatment, and telephone back their advice to the radio station. Within fifteen minutes of the appeal for help, the reply is on the air. Countless lives have been saved, and untold suffering eased, since the service has been in operation.

To supplement it, the U. S. Public Health Service conducts courses and lectures at all principal seaports for ship's masters and seamen, teaching them practical first aid.

The directions are telephoned back to the radio station and transmitted to the ship's master. Below is shown a ship captain's class in hygiene and first aid. Such training qualifies master mariners to administer relief.

Reply November 13, 1936, 11:45 A.M.
RADIO MARINE
 To the S/S "EASTERN STAR".
 THE SYMPTOMS POINT TO ACUTE APPENDICITIS. RECOMMEND FOLLOWING TREATMENT:
 (1) PUT PATIENT TO BED
 (2) NOTHING BY MOUTH
 (3) APPLY ICE BAG OR CLOTH WRUNG OUT IN ICE WATER OVER PAINFUL AREA
 ADVISE POSITION AND DESTINATION. KEEP US ADVISED
 (Signed) MARINE HOSPITAL, KING.



The ship's captain receives the radioed instructions at the bedside of the sick sailor. He is now ready to give emergency treatment, although only fifteen minutes or less have elapsed since he appeared for advice.

America Grows

CULTIVATION OF WORLD'S STRANGEST GRASS

By Edwin Teale



A grove of hardy giant timber bamboo at the U. S. Department of Agriculture experiment station located near Savannah, Ga. Here many types are being tested for adaptability

MORE than 50,000,000 acres of wasteland in southern states are suitable for raising the strangest, most valuable grass in the world.

Government officials, in line with crop curtailment and reforestation projects, are encouraging Americans to plant bamboo, the giant grass of the Orient. Already, flourishing groves are in existence in Georgia, Florida, and California. Boys' and Girls' Bamboo Clubs have been organized. Nearly a dozen commercial nurseries are selling the young plants, and a Department of Agriculture station in California has distributed free stock for experimental plots. Called the most valuable plant in the world, bamboo is on its way to obtaining a foothold in the South.

For more than thirty years, plant hunters from Washington have roamed the Far East seeking bamboos suitable for growing on a commercial scale in the United States. Upward of seventy-five different species have entered the country

and have undergone exhaustive tests. Giant timber bamboo, one of the few types found suitable to our soil and climate, is now being distributed.

This colossal relative of corn, wheat, and timothy sometimes attains a height of 120 feet and is more than three feet around the base. Like a veritable Jack's beanstalk, it shoots upward during the rainy season at the rate of as much as a foot a day. Where roads are cut through bamboo groves, they have to be gone over at frequent intervals. Thirty days' neglect finds them overgrown. A single bamboo root will produce as many as 100 polished, jointed stems that rise into the air as high as an eight-story building.

Only at rare intervals do bamboos flower. Some species produce seed, resembling rice or barley, which is eaten as a grain by natives of India. Other types produce fruit suggesting apples. These are baked and eaten. In addition, the sprouts of bamboo form a staple vegetable for the Far East. They are cooked and served like asparagus. Some years ago, when asparagus was introduced into China and Japan, it was known as "foreign bamboo."

Some groves of edible bamboo in Japan are more than 100 years old. Natives "mine" for the sprouts in winter, digging into the ground wherever they see it humped up by the growing shoots.

Not long ago, a collector exhibited 1,048 different kinds of objects, all made from bamboo. Everything from plumbing pipes to candle wicks, from swords to art work, from pens to water pails, is made from this universal provider. Spoons, bottles, bird cages, canes, wheelbarrows, flutes, blowguns, bows and arrows, fans, ropes, pipestems, kites, houses, brooms, beer,



Close-up of a bamboo root. The pencil points to an "eye" from which a shoot will grow. Left, a pole that grew to a height of more than twenty feet within thirty-seven days

BAMBOO

RECLAIMS WASTELANDS

candy, and a thousand and one other products of infinite variety depend upon it as a source material. The huge leaves of some species are employed as thatching for houses, as raincoats, umbrellas, and wrappings for sweets. Knocking out the joints in the long stems turns them into cheap water pipes. Thousands of these wooden pipes, with the smaller end of one thrust into the larger end of the other, carry water for miles down the sides of the Himalaya Mountains in India.

In the Philippine Islands, there is a pipe organ built entirely of bamboo. It is said to be the only one of its kind in the world. The hard outer skin of some bamboos enables their wood to be used for forming sword blades with durable cutting edges. From the seed of the bamboo, natives of the East sometimes make a kind of beer. From the sprouts they make pickles by soaking them in vinegar; candy by cooking them in sugar. More than 300,000,000 inhabitants of the Orient could hardly exist without the aid of this slender plant now being introduced into the United States.

"It is a curious thing," points out David Fairchild, noted plant hunter of the Department of Agriculture, "that on one side of the Pacific live hundreds of millions of people so dependent upon bamboo they cannot imagine an existence without it, and on the other side 120,000,000 others whose main contact with the plant is through a fishing pole."

One New York dealer alone is importing enough bamboo each year to encircle the globe at the equator. While much of it goes for fishing poles, new uses for the wood are being found each week. Almost every day, he tells me, experimenters come in for small quantities of special bamboos in order to test out innovations. Three American adaptations are fancy bamboo buttons, shape-holders

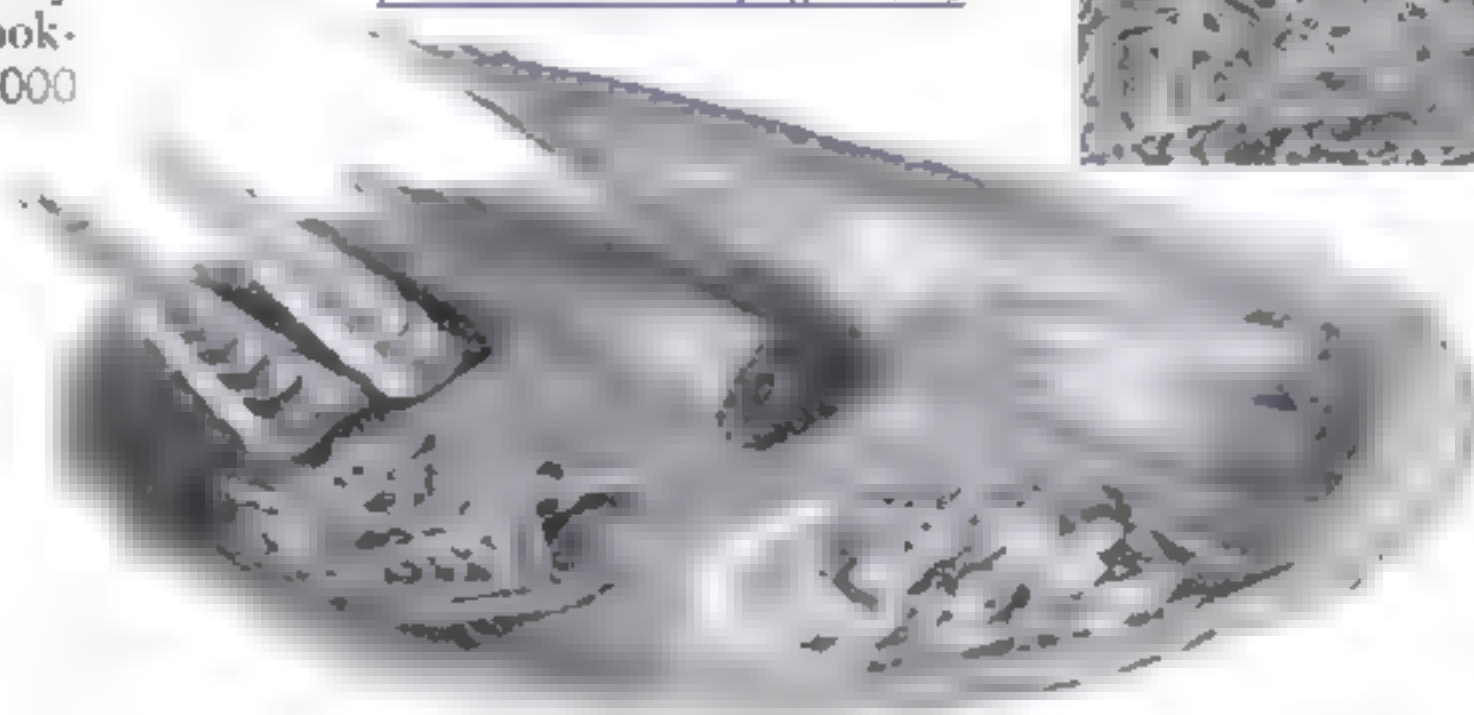
for women's shoes, shredded-fiber wicks for candles. Filled with concrete, the tubes are being used to form reinforced bamboo walls.

Annually, more than 1,000,000 pounds of split bamboo enter the country from the Orient. By stimulating the production of native bamboo, Department of Agriculture officials hope to supply much of this demand.

While the American Government is thus active in introducing bamboo and encouraging its growth, other western nations are similarly engaged. France, for instance, is making special efforts to produce bamboo on a commercial scale in southern departments. Russia also has established experiment stations and commer- *(Continued on page 131)*



This remarkable photograph shows a bamboo stem that has forced its way up through the heart of a decaying stump in the grove run by E. H. Willingham at Way's Station, Ga.

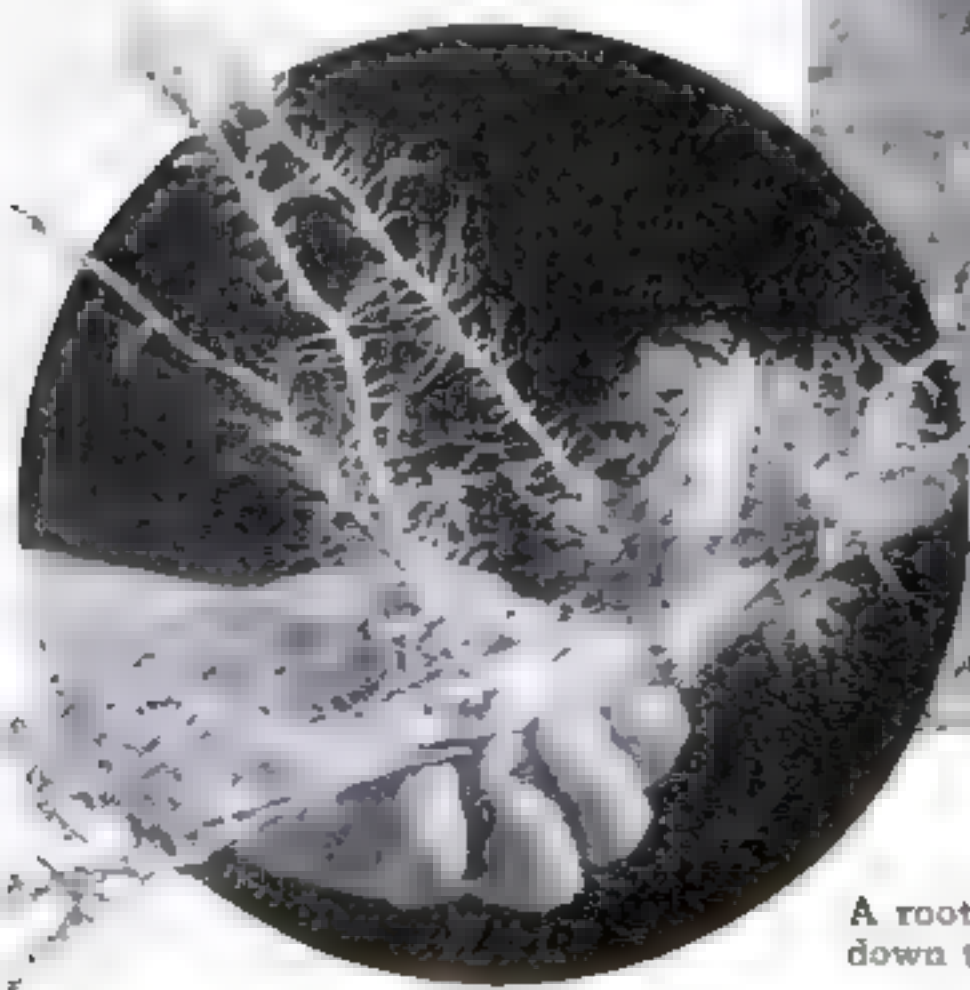


Left, a staple food of the Orient: edible bamboo shoots, shown entire, and sliced for cooking. This delicacy is an important by-product of the useful grass



Bamboo poles are the principal material in this elaborate suspension bridge in Java, in the East Indies. To the natives of the East, bamboo is a source of food and drink as well as shelter and clothing

A root with a shoot just beginning to develop. If a shoot several inches long is split down the middle, the joints of the future bamboo stem can be seen telescoped inside it



EXPLOSIVE DRILL BITES SAMPLES FROM THE OCEAN FLOOR

CORE SAMPLES of the ocean floor are obtained with a new explosive device developed by Dr. Charles S. Piggot of the Carnegie Institution, Washington, D. C. Lowered to ocean

depths as great as 7,500 feet, the apparatus utilizes a cylindrical steel "gun," ten inches in diameter and twenty inches long, packed with high-speed gunpowder. A ten-foot steel tube is so attached to the lower end of the gun that contact with the bottom detonates the powder charge and drives the tube into the ocean floor. When raised to the surface, a core of subterranean soil is imbedded in a hollow brass sampling bit which lines the steel tube. The brass bit is removed and corked at both ends for later laboratory examination. In a recent trip across the North Atlantic, eleven cores were taken from the ocean bed at various locations and depths. In the laboratory, each core was split longitudinally and the two halves spread out hinge-fashion; one section was kept for reference and the other for analysis. Since previous floor-sampling devices have only scraped up surface sediment, the new apparatus is expected to open an entirely new field for research.

Core samples taken from the floor of the North Atlantic. Each has been split, one half for study and the other for record

"GUN"
CARRIES
EXPLOSIVE
CARTRIDGE

"BIT"
CUTS SAMPLE
FROM OCEAN
FLOOR

Detached "bit" being hauled aboard after the shot has been made. Right, how the core sampler looks when assembled for a new shot

LIFE RAFT HAS UNDERWATER PLATFORM

TO SUPPLEMENT lifeboats and life preservers as emergency safeguards for passengers and crews of ships at sea, a new life raft of novel design has just been introduced. Built in the shape of a large bathtub, the raft has a capacity of twenty-five persons. Hanging down from the cork-filled rim of the raft, a rope net has a wooden floor board that enables persons to stand upright in the safety device to

prevent them from being swept overboard in a rough, stormy sea. Loops of rope are attached to the rim and buoyed up by means of cork floats so that persons in the water may grasp them, and thereby cling to the raft for support.



How the raft would be used in a disaster. Picture at left shows suspended platform

DOUBLE STETHOSCOPE LOCATES BODY SOUNDS

DIAGNOSIS of chest ailments is made easier by a new double stethoscope perfected by four California doctors. Sounds within the body are picked up by two sensitive detectors instead of the usual one. By holding one detector stationary and moving the other around, a doctor can not only locate the source, but also gauge the extent of abnormal noises in the lungs, heart, and other organs.



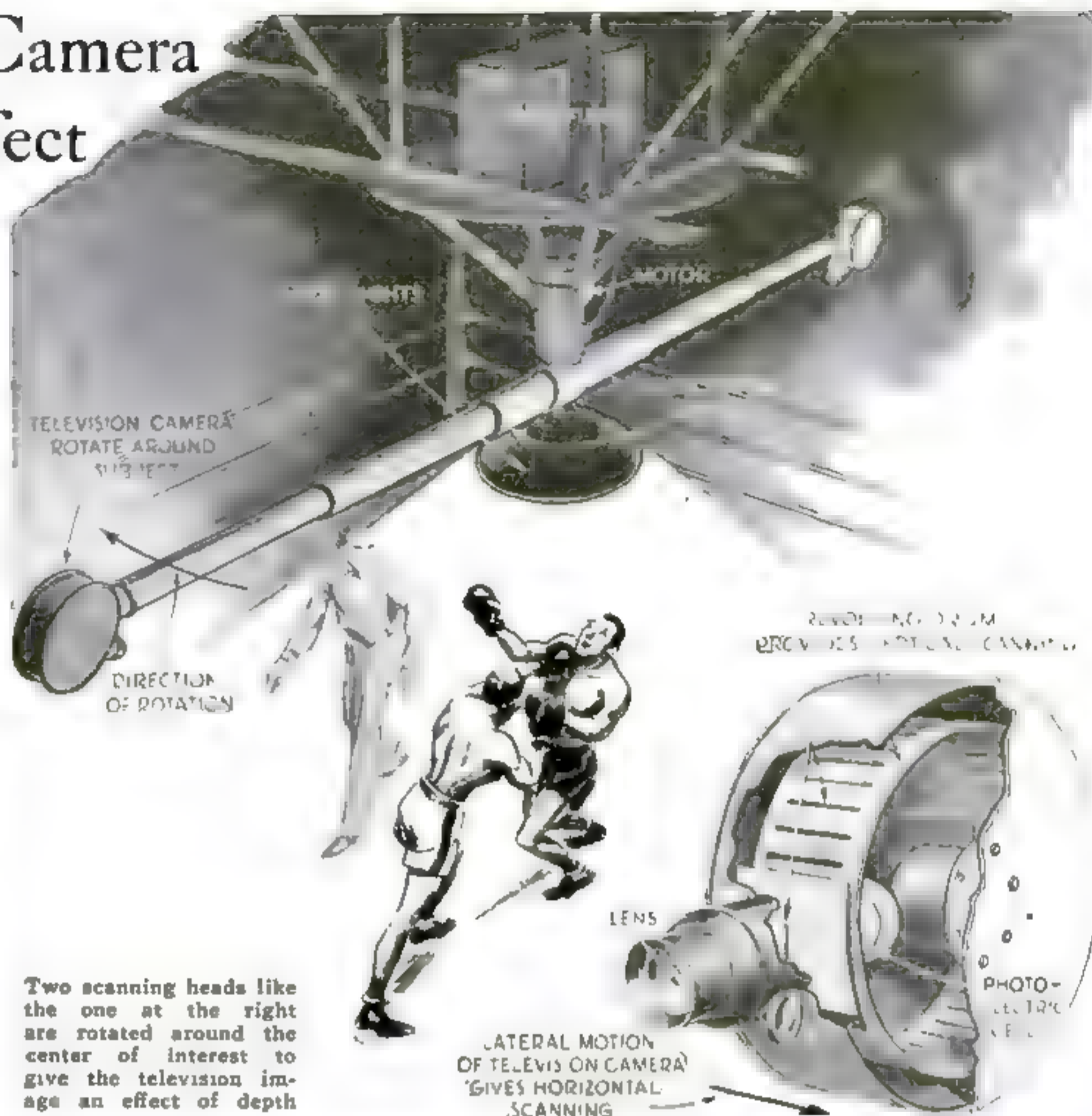
GOLF TEE IS PENCIL FOR KEEPING SCORE

GOLF tee and pencil are combined in a novelty handy for marking down scores. It is made of hard rubber with a metal tip.



New Television Camera Gives Depth Effect

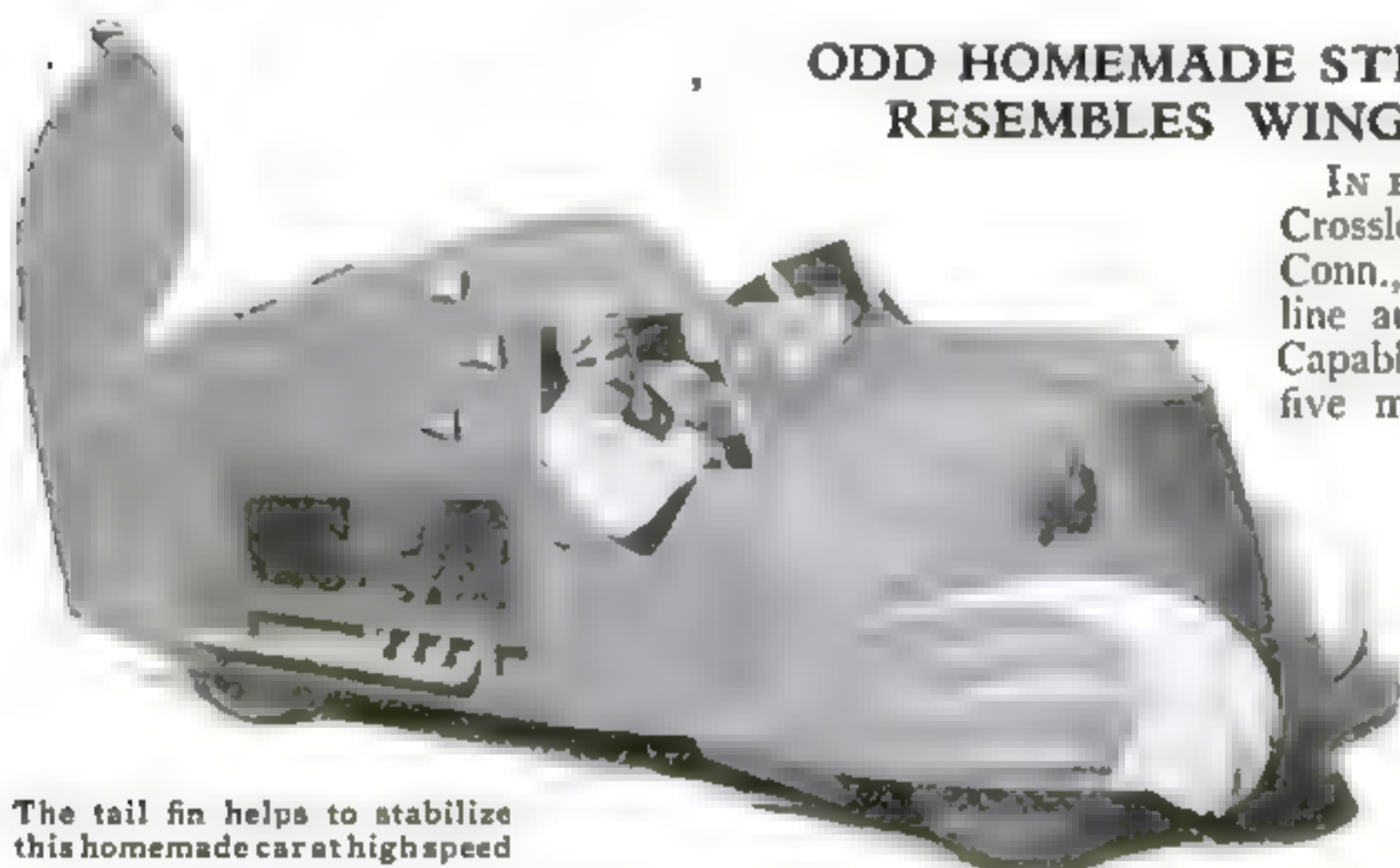
LIFELIKE television images, which give the illusion of three dimensions, are declared to be made possible by a transmitting and receiving system devised by a Bridgeport, Conn., inventor. His plans call for the installation of a scanning head or "television camera" at each end of a telescopic arm, which is rotated at high speed by a synchronous motor over a boxing ring or other center of interest. Revolving slotted drums within the cameras, shown in the cut-away view at the extreme right, break up the image into a series of vertical lines, while the horizontal scanning is provided by the fact that the scanning heads rotate around the subject. Because of the shifting point of view, according to the inventor, the images transmitted possess the illusion of depth. Projected on a cylindrical viewing screen, in a specially designed television receiver, the images can be viewed from any direction, thus enabling a large number of persons to enjoy a television program at the same time. With the cameras pointed so as to converge on a central stage, as shown in the illustration, the effect is what the inventor calls an "internal panorama." The cameras also can be turned to face outward.



Two scanning heads like the one at the right are rotated around the center of interest to give the television image an effect of depth

ODD HOMEMADE STREAMLINE CAR RESEMBLES WINGLESS PLANE

IN HIS spare time, Richard Crossley of East Haven, Conn., built the novel streamline auto shown at the left. Capable of a speed of seventy-five miles an hour, the car runs on airplane wheels. The aerial for the car radio is fastened to a rear stabilizing fin used to aid in steering at high speeds. Note the striking resemblance to the fuselage of an airplane.



The tail fin helps to stabilize this homemade car at high speed



THREAD CUTTER IS BUILT INTO SPOOL

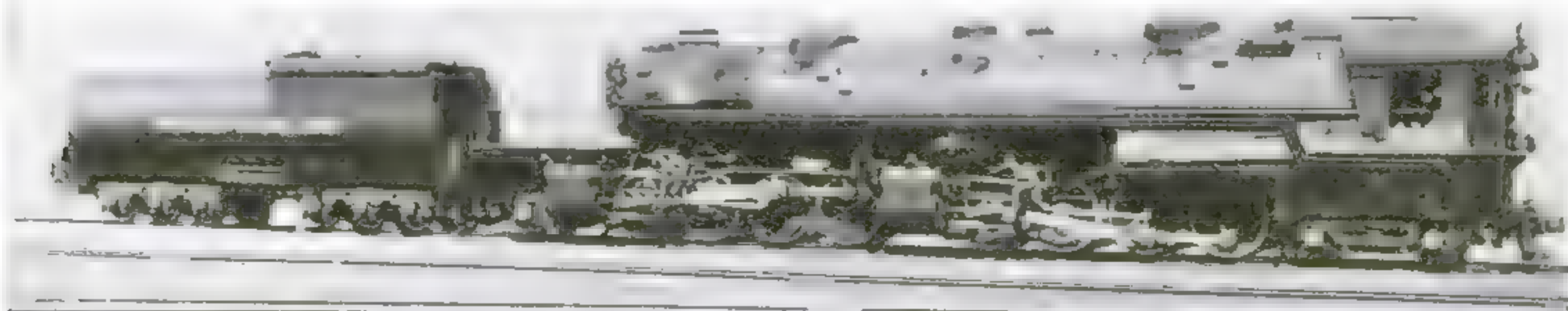
A HANDY new spool for thread has a built-in cutting blade. The blade is fastened across a notch in the spool edge, and thread is severed as shown in the illustration above.

OIL-BURNING LOCOMOTIVE HAS CAB IN FRONT

BACKWARD is forward in a new oil-burning steam locomotive recently placed in freight service by a Western railroad. The driving cab of the odd engine is at

the front instead of the back end, giving the engineer a clearer and wider view of the track ahead. Headlight, bell, and cow-catcher are placed at the cab end of the

powerful articulated locomotive, which was built for the purpose of hauling long, heavy freight trains at high speed over steep mountain grades.



Cab and fire box are at the front of this new locomotive, cylinders toward the rear. Oil burning makes the unusual arrangement practical.



Moissaye Boguslawski showing how he teaches proper finger pressure

WEIGHS TOUCH OF A FINGER ON PIANO KEY

A UNIQUE system developed by Moissaye Boguslawski, a Chicago, Ill., pianist, is used to instruct pupils in applying the correct amount of finger pressure necessary to produce the proper tonal value of a piano selection. While striking a piano key with the finger of one hand, the instructor touches a small weighing scale with the same pressure by a finger of the other hand, so that the scale indicates the actual finger pressure used. In the forceful rendition of Rubinstein's "Staccato Etude," the pianist estimated that he uses a total finger pressure of more than 14,000 pounds during the six minutes required to play that selection.



Glasses with silvered lenses to cut glare. Right, a lens being employed as a mirror

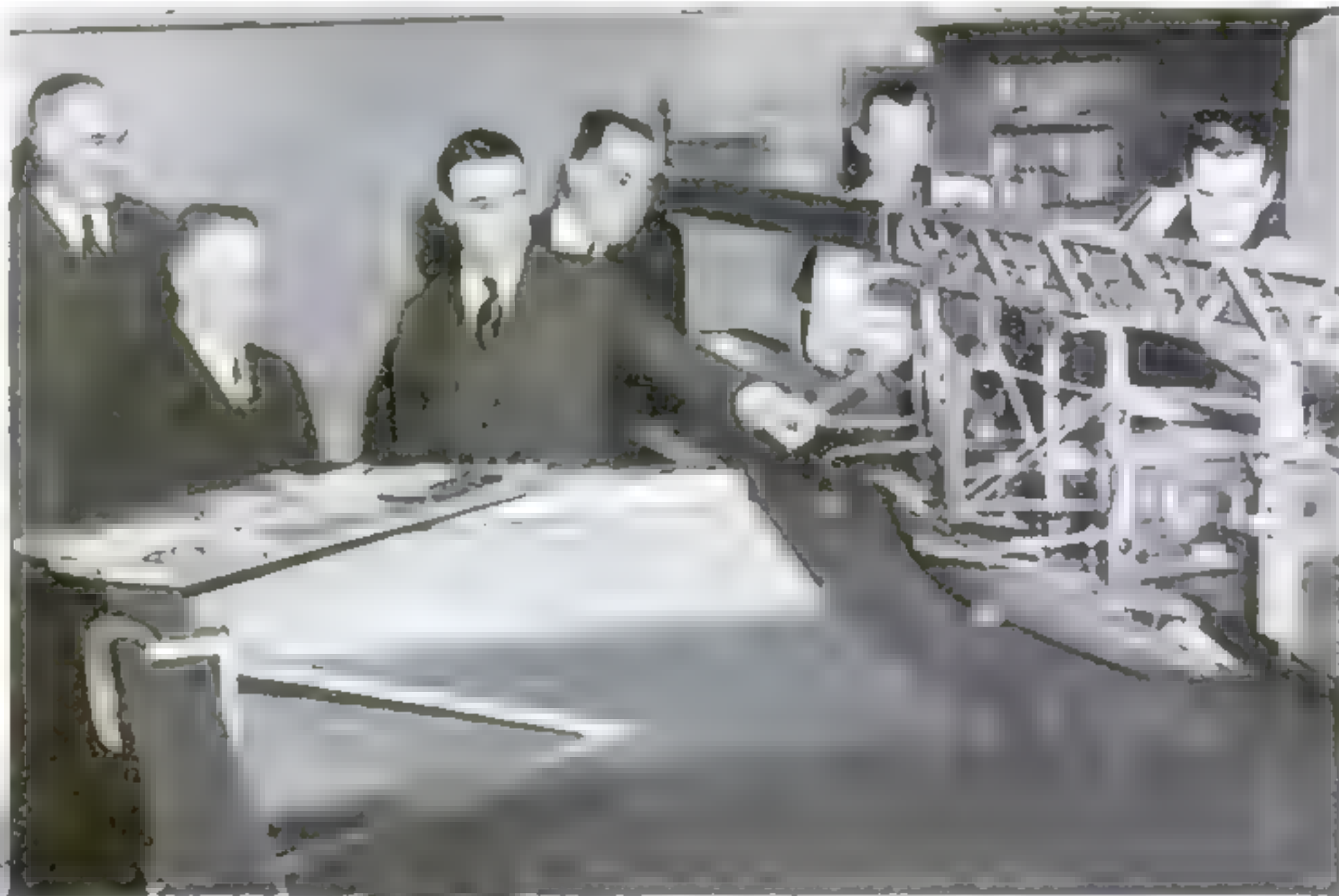


SUNGLASS LENSES SERVE ALSO AS MIRRORS

LENSES in novel sunglasses recently introduced act as mirrors as well as eye protectors. The glasses are treated with a very thin coating of silver which reflects much of the brilliant sunlight, so that light transmitted through them has a glareless, bluish hue. Since the fronts of the lenses, however, reflect light of all wave lengths, women have found the unusual glasses useful as make-up mirrors.

TANK AND MODELS TEST AMERICA'S-CUP YACHT

TO OBTAIN the fastest possible sailing yacht for defending the America's Cup in next summer's race with England's entry experimental yacht models were tested recently in a steel water tank at Stevens Institute of Technology, Hoboken, N.J. Hull models of various designs were suspended from a carriage on an overhead steel track, and lowered into the 24,000-gallon tank, which is nine feet wide and over 100 feet long. By weighting and tilting the four-foot hulls, their speed, buoyancy, drag, and other racing factors were estimated as they rode artificial waves representing conditions in the ocean.



Scientists at the Stevens Institute of Technology testing a model yacht hull in a large tank of water



Mobile outfit for checking large commercial scales. It includes fifteen 1,000-pound weights

TRUCK CARRIES WEIGHTS FOR CHECKING SCALES

OFFICIALS who are responsible for checking the accuracy of large commercial scales will be aided by a mobile scale-testing unit just devised by the National Bureau of Standards, Washington, D.C. Fifteen cast-iron blocks, each weighing exactly 1,000 pounds, are carried on a truck whose weight empty is precisely 23,000 pounds. To move the weights onto a scale being tested, each is clamped in a rubber-tired cart, so designed and balanced that even a small boy can lift and move a half-ton block with ease. On larger scales, the 23,000-pound truck is used to supplement the iron weights and extend the testing range to its full extent of 38,000 pounds.

Practice Courses Teach Safe Car Driving

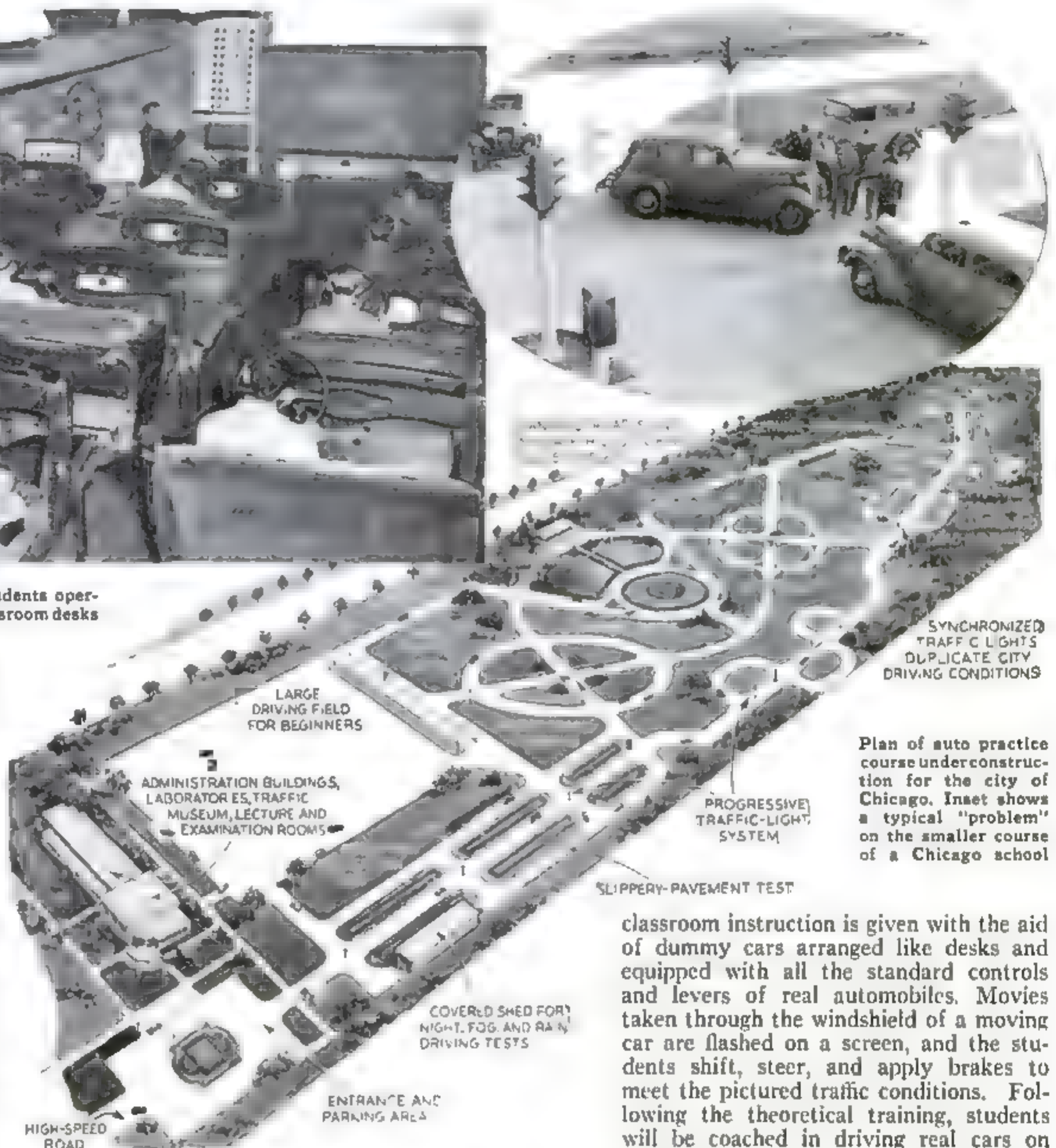


A high-school driving class. Students operate dummy cars arranged as classroom desks

LESSONS in automobile driving, instituted by many high schools and municipalities recently, are now being supplemented by the construction of large practice driving fields scientifically planned by safety engineers. In Chicago, an elaborate, city-owned driving course for beginners will include hills, curves, parking areas, traffic lights, and even a section of slippery road to provide a test for every possible type of driving condition. Permanent buildings will house testing laboratories, classrooms, and a large museum of safety exhibits. Lessons will be given free of charge to anyone who desires them, and the city will supply cars for those who do not have automobiles of their own. Judges in city courts are expected to send traffic violators to the prac-

tice course for lessons in safe driving. A smaller driving course has been built in the same city for students of the Lane Technical High School, where preliminary

classroom instruction is given with the aid of dummy cars arranged like desks and equipped with all the standard controls and levers of real automobiles. Movies taken through the windshield of a moving car are flashed on a screen, and the students shift, steer, and apply brakes to meet the pictured traffic conditions. Following the theoretical training, students will be coached in driving real cars on the school's new practice driveway. Driving lessons are compulsory at the school, and it is estimated that about 4,000 students will complete the training course each year.



Plan of auto practice course under construction for the city of Chicago. Inset shows a typical "problem" on the smaller course of a Chicago school

CRANE SPEEDS LOADING OF LUMBER TRUCKS



Containers of cut timber being transferred from tractor trailers to highway trucks

SET UP at the edge of a forest, a new portable loading device quickly transfers cut timber packed in wooden frames from tractor trailers onto large motor trucks for transportation to sawmills. Cables attached to a steel girder supported by telescoping arms lift the container off the trailer, and the arms swing it over the truck. The crane can be dismantled in two hours, and carries its own lighting system for night use.



ELECTRIC HEATER FOR TEST TUBES

TEST TUBES are quickly and safely heated in a new electrical device, shown above. Liquids in a tube held in the special horseshoe-shaped heating element will boil in about thirty seconds, while inflammable materials are less likely to catch fire than if heated over a flame.

Hollywood Improves

IN MAKING OUTDOOR MOVIES



A beach on Santa Catalina Island off the California coast is dressed up with artificial palm trees to represent a tropical scene. The director is planting imitation grass on the beach floor for audience sequences.

Nature at her worst sometimes bedevils a movie company on the desert. Sand, charged with electricity, beats against microphones and cameras, spoiling the recording of sounds. Shots and shouts fade over the dunes and lose their power. Winds blow when they are not wanted, and die down when storms are desired.

No desert picture is considered complete without a sand storm, yet one company remained two weeks on the Arizona desert awaiting a good blow. At last, four tractors pulled a battery of heavy wind machines from the near-by highway to the scene. For three days, actors labored under the blasts of artificially produced winds, and the night the picture was completed real wind began to blow! For three days the storm raged, while 100 men stood guard around the large sets, stacking sandbags against the bases and keeping the structures well braced against the untimely onslaught of nature.

The use of color in pictures complicates the photographing of natural scenes, particularly those involving sunsets, flowers, and snow. But the property man, the camera man, and the director are on hand with their boxes of tricks to help nature out of a difficult situation.

WITHIN 400 miles of the movie capital at Hollywood, Calif., may be found 10,000 "locations" for outdoor pictures, representing at various seasons of the year every place on the globe, from the Gobi Desert to antarctic wastes. Yet, no matter how well nature has builded for the movie makers, frequently she is too harsh in her photographic effects, or she has not supplied all that the camera demands for beauty and realism. The most complicated of scenes can be played in natural settings, but the magic makers of Hollywood are continually improving upon nature and making her do their bidding.

Recently, 1,500 actors and extras rode along a plank road into the shifting sand dunes near Yuma, Ariz., to film a series of battle scenes. At the end of the first day's shooting, test strips of the negative developed in vacuum bottles revealed that the sand, which appears dull to the eye, glinted and cast reflections into the camera. A quick call to Hollywood by short-wave radio brought, before dawn, a quantity of lampblack. Thereafter, before each scene, sweepers equipped with brooms and rakes smoothed the desert within a range of 300 feet of the cameras. Following the sweepers, water turned a dirty brown with the lampblack was played from a fire hose on the sand, thus killing the glint and providing a better, nonreflecting photographic quality.

By Andrew R. Boone



When mountains interfere with a setting, movie wizards remove them, as below, by erecting a smoke screen to hide the hills from the cameras. At left, a technical man with a head company is developing a strip of film in a vacuum bottle to test the quality of the day's work.

on Nature

In "The Trail of the Lonesome Pine," first outdoor feature to be filmed in natural colors, the camera crew got up before dawn on four mornings in succession, to be on hand when the sun rose. They knew that in black-and-white motion-picture photography, a sunrise when reversed makes a better sunset than the real thing, largely owing to the absence of dust in the air. But tests of the morning's shooting revealed a total absence of those indescribable evening colors, and when, at last, the director called for a romantic pair to stroll in the sunset, the sun actually *was* racing down over the western horizon.

Sometimes, though, nature may be bested. Other scenes showed broad fields of flowers. This time tests revealed that the brilliant near-by tones "killed" those of the more distant flowers, and a score of workmen spent a half day thinning out the blooms within 400 feet of the camera; when action started again, nature was "in balance."

While working high in the mountains in early spring, a director awoke one morning to find that snow had fallen during the night. He assembled a battery of powerful incandescent lights, switched on the generator, and melted the snow over a 200-foot circle, so that the day's shooting might go on as scheduled.

Snow has peculiar effects, both on the appearance of actors and on film. Recently, when a troupe moved by sleighs into



**THE STUDIO
TAKES THE FIELD**

A camera crew filming a winter scene near Lake Tahoe, Calif. The camera is mounted on a truck with four rubber-tired wheels, which rolls on a solid runway laid across the surface of the soft snow

mountainous country near Truckee, Calif., the cameraman took several tests and found, to his amazement, that instead of reflecting a brilliant white light, the snow was giving off a dark blue; that the dark leading man had become a blond, while the blond leading lady had turned brown. Reddish-brown make-up was applied to the faces, a yellow filter fitted to the camera, camera lenses were opened wider, and the snow's strange light effect was overcome.

Deep in the Potlatch Forest, 100 miles

from Lewiston, Idaho, another company recently set up cameras to film for "Come and Get It" the spring break-up of the Clearwater River, expecting to catch the spring drive of tens of thousands of logs. But the weather became colder instead of warmer, and the river froze even more solidly. At last, in order to beat nature at her own game, dynamite blew into bits the dam behind which the timber had been piling up all winter, while other heavy charges started the ice moving down river. *(Continued on page 114)*



With this ultra-short-wave radio set, scattered groups of horsemen were directed in a desert battle scene. Left, technicians spraying the sand with colored water to kill the glare and improve photographic qualities



ARMY OF PARASITES BRED FOR

War on Insect Pests

*Science Searches the Far Corners of the Earth
For Tiny Marauders to Guard Citrus-Fruit Trees*

By Grover C. Mueller

Tiny parasites like this, some of them only a fiftieth of an inch long, are man's allies against insects that destroy citrus orchards

PARASITES numbering in the quadrillions, some so tiny that they cannot be seen by the naked eye, are being marshaled by science on a hundred fronts in a dramatic war of extermination. Their enemies are other insects which infest lemon and orange trees and cause millions of dollars worth of damage every year.

Scientists comb the world for parasites which will destroy harmful insects. Scale insects—black, red, purple, gray, and yellow—white flies, rust mites, and citrus mites are the principle offenders. From the Fiji Islands, South America, Africa, Australia, and the Orient come the shock troops which are saving the citrus industry of Florida, Louisiana, Alabama, Texas, Arizona, and California from destruction.

Scale insects offer the most serious problem. The females deposit their eggs on a branch, except in the case of the red variety, which actually bears young. For two days after birth, the larvae crawl a foot or two on the same twig; then they settle down, begin to feed, and start secreting a fluffy, cottony substance which later molds as a hard shell. The male has two wings, the female none, and both are alike until they shed their skin for the first time. The male backs out of its shell and flies away when it reaches adulthood. And all these, mind you, are no larger than the head of a pin.

Now come the parasites. Those that attack scale insects are carnivorous and, like other members of the wasp family, have stingers. In countless numbers, they swarm through citrus trees, back up against the scale insects, sting them, and deposit eggs within their bodies. A few hours later the eggs hatch, and the larvae feed on the internal fluids and consume the vital organs. One parasite will lay from fifty to 5,000 eggs, usually one in each host, though sometimes several eggs will be deposited under a single shell.

Take the case of white, or cottony cushion, scale, now a thing of the past. According to Prof. H. J. Quayle, of the University of California's Citrus Experiment Station, this pest was first found in an acacia tree at Menlo Park, Calif. Since the tree itself had come from Australia, an entomologist sailed for that continent to discover the nat-

ural protection, and found a small two-winged fly which was attacking the scale there.

Soon, several thousands of these flies were liberated among California groves. Meanwhile, a ladybird beetle was found feeding on the same scale, and twenty-eight specimens were shipped to California. Within a few months, 10,000 ladybirds were liberated. So effective did they prove that within one year the pest was under control. Later, other ladybird beetles were sent to Florida, where the California success was repeated.

Since then, many other parasites have been imported to aid in the fight, though none has been so successful as the parasites recently introduced from Australia to prey on a species of mealy bug, an unarmored scale insect. This insect first appeared on citrus trees in California in 1913. It spread rapidly, and soon 100,000 acres were infested. Spraying and fumigating had no effect. Recently, Harold Compere, assistant in entomology at the Citrus Experiment Station, sailed for Australia on his strange search. On a plant in the Botanical Garden at Sydney he found a small

colony of mealy bugs. Although a few parasites were found attacking the bugs, the mealy bugs themselves were so scarce he almost gave up in despair. Then, one day, he happened to find in the back yard of a small residence a mulberry tree well infested. From it he took five parasites and brought them back to California. From two of them were reared several thousand descendants which, in the short space of two years, cleaned up the pests on this large acreage.

So prolific are these marauders, I was informed by Prof. H. S. Smith, who is in charge of biological control work for the station, that only one fertilized female need be liberated on each acre of trees. Feeding on mealy bugs and their eggs, one female will produce millions of her kind in a year.

Except for red scale, the fight today has been won. By the foregoing and similar methods, white, black, purple, gray, and yellow scale, flies, and mites have largely disappeared or are under control. But the battle never ends, and efforts have been doubled to subdue not only red scale but also all remaining, scattered insects attacking the trees.

Recently I saw within the white-walled rooms of the experimental station's insectary the white larvae of Barbados black beetles walking about on squash infested



Left, a parasite laying its eggs under the shell of a scale insect. When hatched, they devour the host



A sago-palm tree infested with parasites being packed in a screened cage for shipment to America from the East Indies. Scientists comb the world for tiny marauders to turn loose against costly tree pests



Portable vaporizer and canvas tent designed by University of California experts for use in spraying fruit trees. Operated by one man, it surrounds a tree with hydrocyanic acid in the form of a vapor to kill harmful insects

with red scale. These parasites first were imported into the Fiji Islands to battle insects infesting coconut trees, and later were carried to southern California, there to be tried out for their effectiveness on red scale. Squash have proved excellent media on which to grow red scale in the laboratory, and I saw several of these vegetable guinea pigs literally covered with the insects.

Near-by were potato sprouts infested by mealy bugs. On these plants many parasites were still attacking in wholesale numbers the defenseless bugs, and I saw countless holes in the mealy-bug shells through which their attackers had fled after destroying their hosts.

Every precaution is taken to prevent these tiny killers from escaping. Doors from the rearing rooms lead into black halls to discourage them from taking wing to the outer world, for they always move toward light. Heated air, which speeds their reproduction, enters through an inlet in the roof and double, wire-reinforced windows resist breakage.

When a shipment of insects reaches the experiment station from Calcutta, Suez, Rio de Janeiro, or Sydney, only one man is permitted to unwrap the palm tree to which they cling or the metal-encased cheesecloth, moistened to keep the valuable raiders alive. By steamship and ocean-spanning flying boat these parasites arrive, plucked from infested plants on the other side of the world by American scientists and foreign agents.

Stanley E. Flanders, associate in entomology, has the very important task of separating these destructive insects from their containers. Some are numbered among the smallest insects in the world. One hundred mynaarids, laid in a straight row head to tail, would scarcely measure one inch in length. Related to the bee family, these are fully developed animals, with three pairs of legs and two long feelers. When I viewed one under a microscope, it resembled an X-ray photograph of a bee and was so tiny, Flanders assured



Parasites being liberated from a test tube on an olive tree. Left, a worker collecting the insects from a glass cage by sucking them up into a tube

me, that it could fly into my eye and I would not be aware of its presence. Yet they prey on the eggs of other insects, destroying life before it has a chance to begin.

When a package reaches the insectary, Flanders places it within a glass-covered cage. Through arm holes in a side wall he brushes the parasites off the plant leaves or cloth. Soon they crawl onto a cloth facing the near-by window. It then is a simple matter to pick them off by sucking them into a glass tube.

After separating the good from the bad under a microscope, Flanders places the parasites on short stems of plants in glass vials. Then follows a period of watchful waiting. If the insects deposit their eggs on or in the scale insects with which these stems are infested, he knows they will be effective in combating the pests. From here they are removed to breeding cages and soon are on the road to production by countless millions.

The rapidity with which these parasites increase staggers the imagination. Not long ago, Compere sailed for Brazil in quest of parasites which would attack red scale. He found red scale, but no parasites. However, while walking through a garden near Rio de Janeiro he found several black-scale parasites.

Some weeks later, one female was placed on a mealy bug. She laid eggs and soon

the larva devoured their host. These in turn reared other young, and within eighteen months 6,000,000 were liberated from the insectary and poured from glass tubes into southern California citrus trees to take up the battle on black scale.

To destroy red scale by parasitic attacks has proved almost hopeless. Entomologists have scoured the world for insects which would rid the nation's citrus groves of this blight, but to date neither insects nor disease has proved effective. White flies and fungus diseases have been tried, but cool winters and dry climates killed the flies and the disease before they could even start their beneficial work.

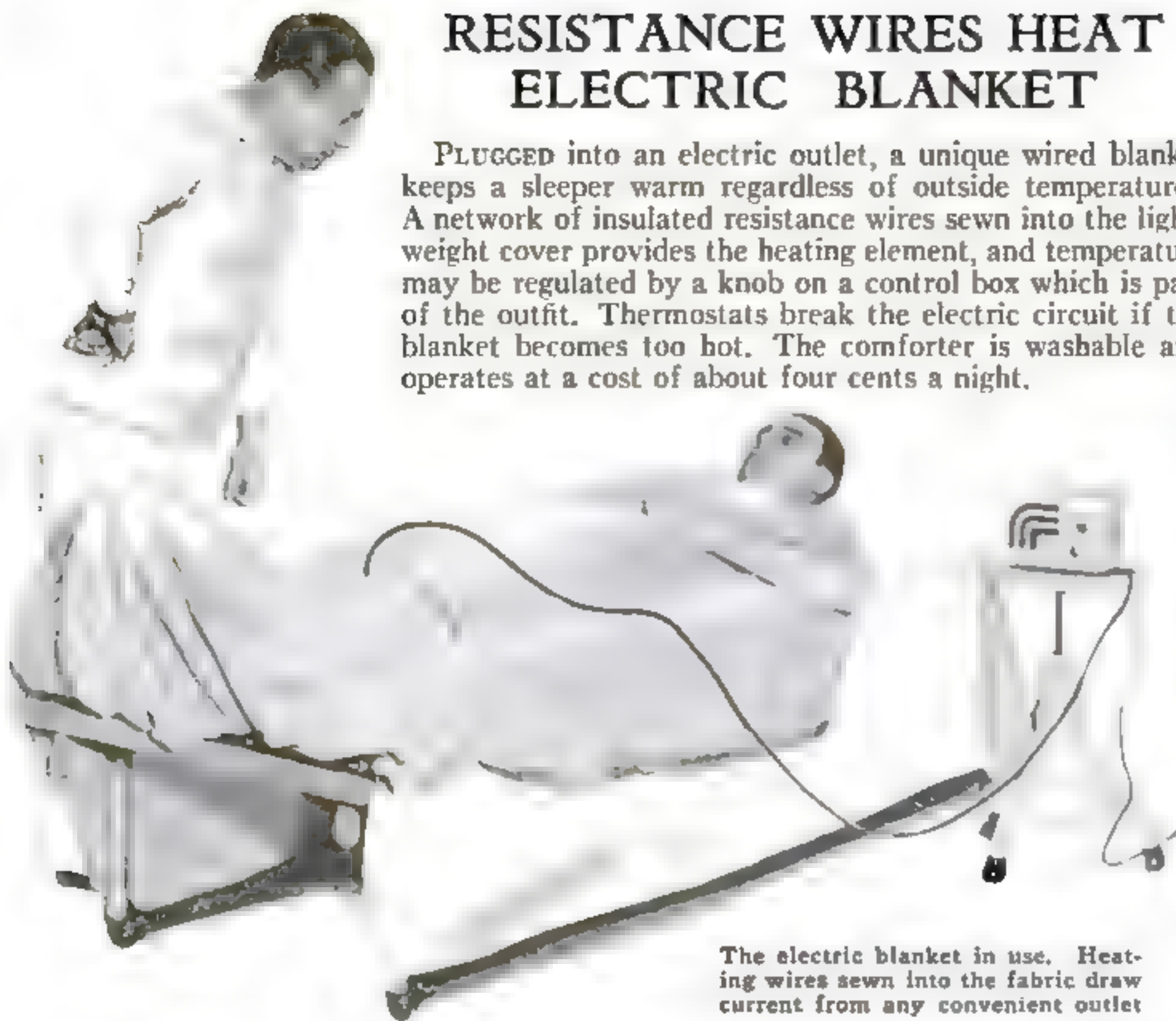
Compere's South American exploration was looked upon as a "last-resort" search for red-scale enemies. But these scientists never give up the eternal war. In a few months this explorer, bronzed by the suns of many lands, will sail once more, this time for Africa. Through Uganda and Kenya, and possibly farther into the interior, he will scout for red-scale parasites. He has a slender lead. Another scientist has reported their existence. But whether they will attack the American type of red scale or will themselves perish in a new climate, only time can reveal.

Science's attacks on insects do not end in the laboratory, nor are they confined to setting parasites on host insects. Poison powders, sprays, and war gases—phosgene, arsine, and mustard—have been set to work with deadly effect. Where these fail, stomach insecticides are applied.

Sometimes the insects build up a resistance to one form of poison. For several years, fumigation proved satisfactory to kill most scale insects, but after three decades growers in one southern California district reported red scale increasing despite their efforts to beat it back. Professor Quayle went into the orange and lemon groves, ordered *(Continued on page 127)*

RESISTANCE WIRES HEAT ELECTRIC BLANKET

PLUGGED into an electric outlet, a unique wired blanket keeps a sleeper warm regardless of outside temperatures. A network of insulated resistance wires sewn into the lightweight cover provides the heating element, and temperature may be regulated by a knob on a control box which is part of the outfit. Thermostats break the electric circuit if the blanket becomes too hot. The comforter is washable and operates at a cost of about four cents a night.



The electric blanket in use. Heating wires sewn into the fabric draw current from any convenient outlet



ROYAL ACORNS CANNED FOR PLANTING ABROAD

ACORNS from oak trees in the royal park near Windsor Castle, England, are being packed in cans for shipment to all parts of the British Empire. The acorns will be removed from their tin containers and planted in the various English dominions and territories in commemoration of the coronation ceremonies scheduled to take place in May.



ELASTIC BINDS PAPERS

ELASTIC webbing held together with metal hooks forms a handy method of filing stacks of letters, papers, or documents. Looped through two holes punched in the papers, the flexible device expands so that thick, bulky files of letters can be fastened together without tearing.

CAMERA GUN TEACHES CORRECT AIMING

GAME BIRDS are "shot" with a novel camera gun devised by an Austrian hunter. The inventor replaced the barrel of a shotgun with a miniature camera and telescopic lens. Stiff wire connects the trigger with the camera shutter so that the device can be aimed and "fired" like a gun. When developed, the film indicates whether the hunter would have hit or missed his swiftly-moving targets had the gun been real.



Aimed like a shotgun, this camera device makes telescopic photographs of game to aid a hunter in correcting faults in aiming a real piece

FLYING LABORATORY TESTS SAFETY DEVICES FOR PLANES

EQUIPPED with every safety device regularly used on commercial transport planes, a twin-motored Lockheed monoplane has just been completed for use by test pilots of the U.S. Bureau of Air Commerce as a flying laboratory. The plane will be placed in service to check present air-line equipment, to develop new safety features and aids to air navigation, and to make trial landings and take-offs to test blind-flying equipment. Outstanding among the many existing features of the experimental plane are devices designed to prevent the formation of ice on wing edges, propeller blades, and radio antenna.



Twin-motored monoplane used by the U.S. Bureau of Air Commerce in trying out safety devices for commercial airliners. Among other tests, it will make experimental take-offs and landings with the pilot flying blind

FIRE TRUCK SPRAYS CARBON DIOXIDE ON BURNING PLANE

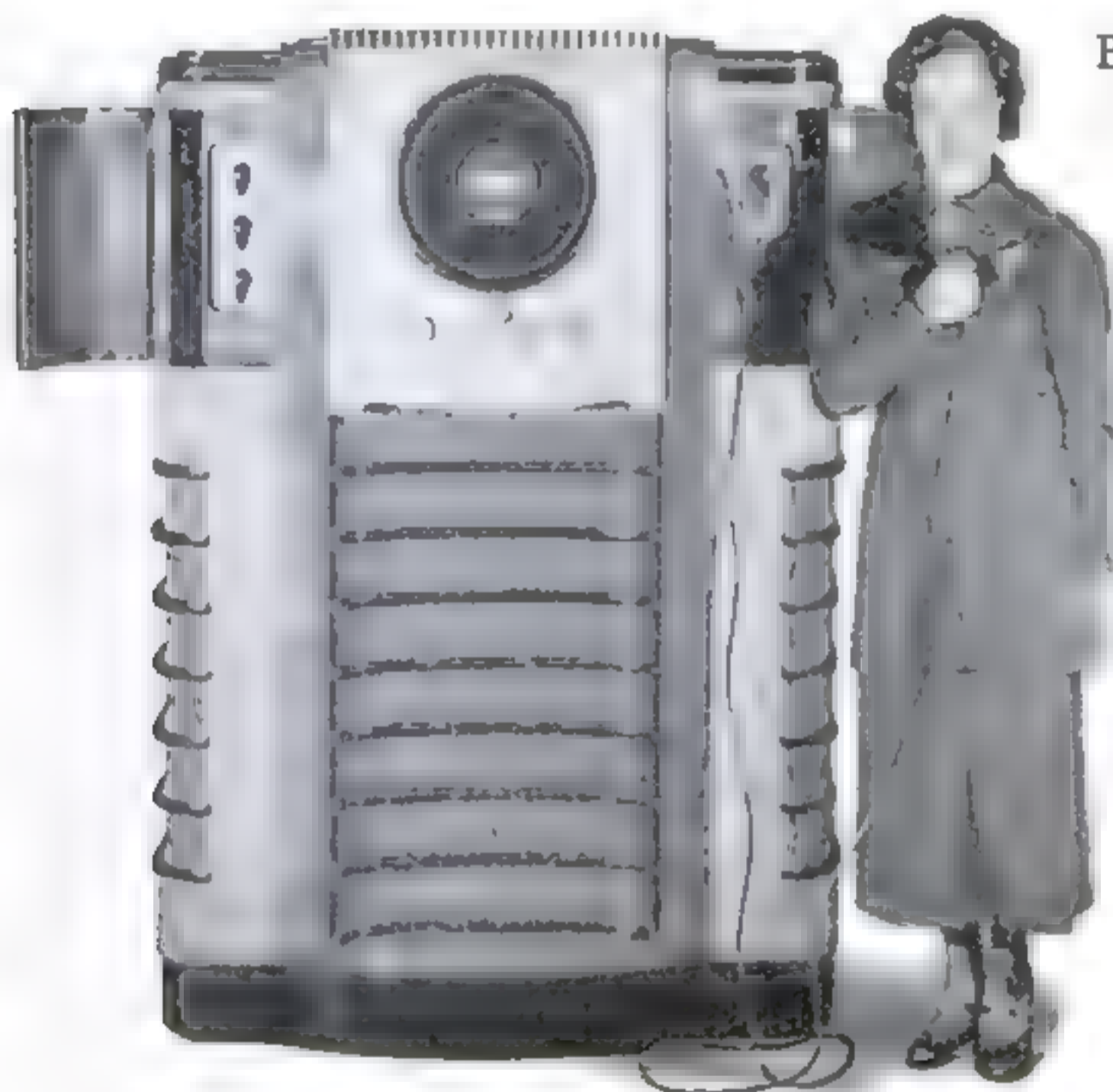
Below is the odd fire truck used at Le Bourget airdrome, Paris, France, for putting out plane fires. Left, the apparatus in a test



TO EXTINGUISH airplane fires at Le Bourget airdrome, near Paris, French officials have just placed in service a novel eight-wheeled fire truck. Metal cylinders containing fire-choking carbon dioxide gas are stacked on the rear end of the vehicle and connected to a powerful pumping

mechanism. When a plane fire breaks out at the airport, the truck speeds to the scene and pours clouds of the gas through a chutelike nozzle jutting out in front of the machine. In the photograph at the left, above, the fire-

fighting apparatus is shown in a recent test, choking the flames in a dummy plane which had been soaked with gasoline and set on fire.



BIG RADIO HAS SIX SPEAKERS

STANDING more than five feet high, a giant, 475-pound radio set just completed has four separate chassis, thirty-seven tubes, and six loudspeakers of various sizes. Capable of reproducing sounds whose frequencies range from twenty to 20,000 cycles, the receiver is said to retain faithfully all of the delicate shadings of music as originally played in the broadcasting studio. A microphone permits the set also to be used as a public-address system.



WHEELED TIRE WRENCH

CHANGING automobile tires is made easy by a handy lug wrench equipped with wheels. As shown above, a spare wheel is balanced on the wrench and rolled into position. The tool also acts as a lever to raise the wheel to axle height.

"ARC GUN" WELDS PARTS OF ENGINE BOILER

WHAT is believed to be the first all-welded high-pressure locomotive-type boiler has just been completed by a Buffalo, N. Y., foundry. The barrel and dome sections of the boiler were electrically welded with special shielded-arc equipment which resembles a tiny cannon. Welded construction of the boiler eliminated the large amount of seam calking necessary with the conventional method of riveting the joints.

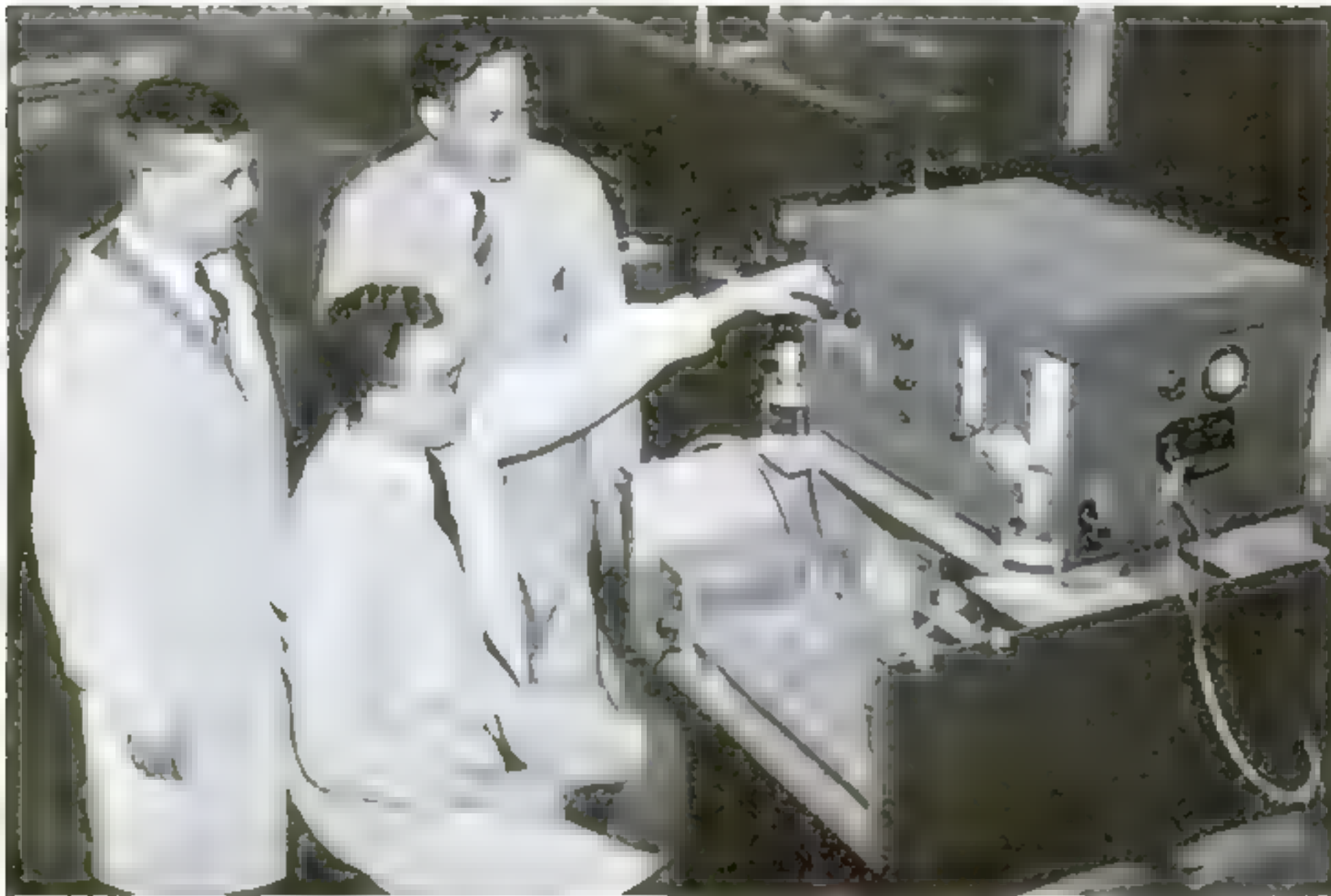
SEEK GREASE IN DRAINS

TO MEET an acute shortage of fats and greases, Germany plans the large-scale recovery of grease from drainpipes. The unusual expedient is expected to yield from 24,000 to 30,000 tons annually, according to reports.



Strange cannonlike arc-welding machine in operation to join the parts of a high-pressure boiler

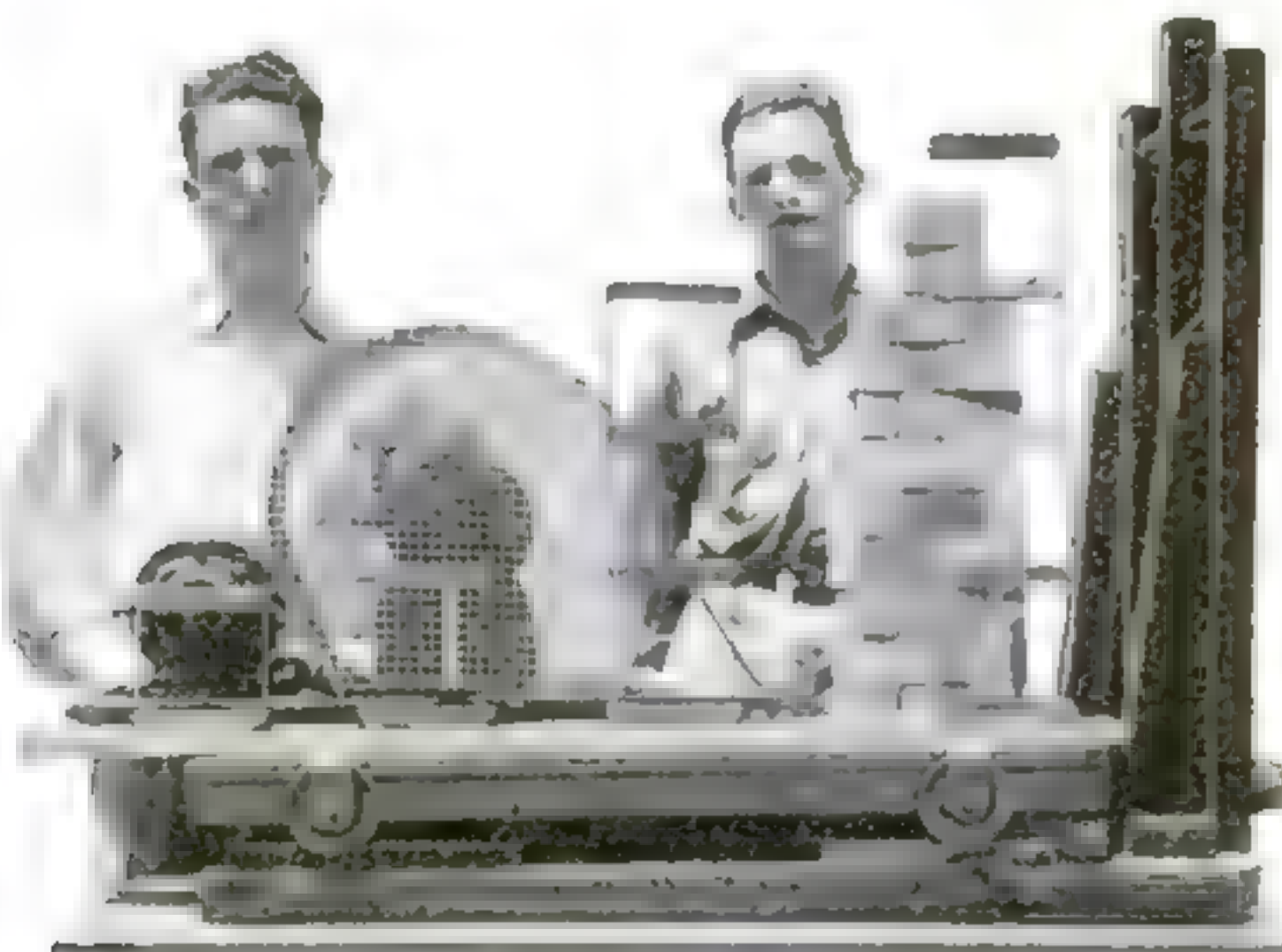
Electric Meter Detects Body's Hidden Ills



Electric currents in the body, measured by this new device, give the clew to obscure illnesses

BODILY ills may soon be detected by electrical instruments long before they can be discovered by any other means. A new electrical device called a "vacuum-tube microvoltmeter," devised by Yale University scientists to study the physiological changes of the human body, is expected to rival the microscope in the examination of biological processes. When connected to the body, the apparatus is said to detect the presence of electrical currents as small as five one-millionths of a volt. Tests on a wide variety of animals indicate that every living thing generates electricity in measurable amounts, that each species has a characteristic electrical pattern, and that variations in the living processes of the animals result in a changing electrical pattern. Tests on mice detected the beginnings of a cancer growth long before disease could have been diagnosed by ordinary methods. By studying the electrical currents of the body, scientists may discover how living organisms maintain their identity in spite of continual changes of tissue.

READERS BUILD EARTHQUAKE TEST TABLE



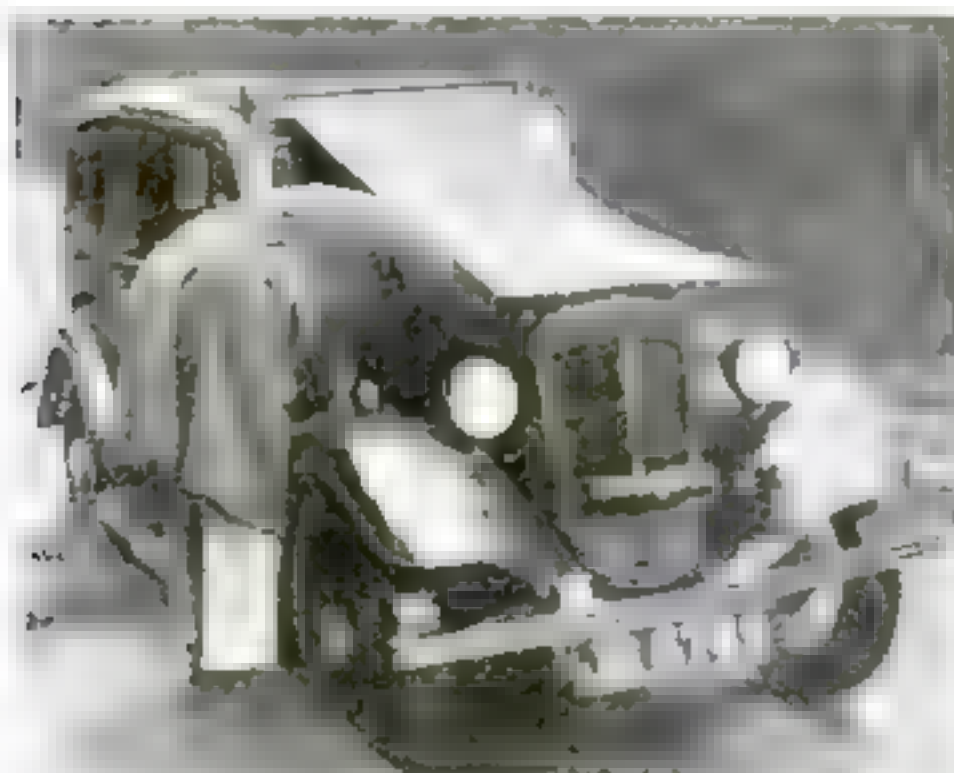
Homemade machine shakes models to measure earthquake resistance

FROM a description published in **POPULAR SCIENCE MONTHLY**, two science students of Phineas Banning High School, Wilmington, Calif., built the earthquake testing table shown at the left. The apparatus is supported on old garage-door wheels that run on an angle-iron track. An electric motor whirls an off-center flywheel to create an "earthquake" vibration for testing the resistance of model buildings.



WINDSHIELD DEFROSTER POWERED BY FAN BELT

A **MOTORLESS** windshield-defrosting fan, pictured above, causes no drain on a car's battery or vacuum system. Driven by means of flexible shaft connected to the motor-fan belt, the defroster clamps to the steering column and can be adjusted to blow in any direction.



CANOPY KEEPS OUT RAIN DURING ENGINE REPAIRS

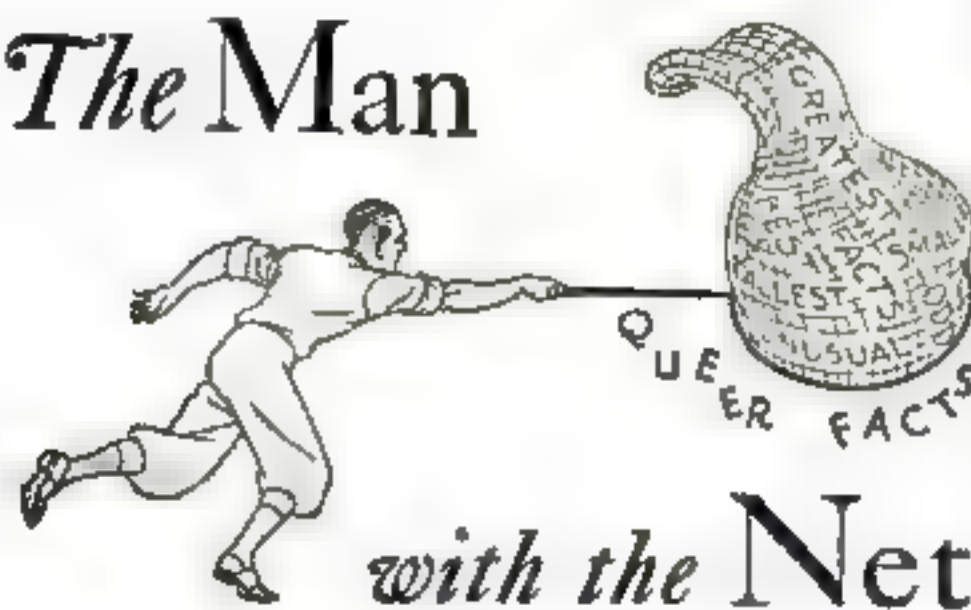
ATTACHED to the roof of an automobile, a novel canvas shield, shown above, protects a motorist forced to make emergency engine repairs in rainy weather. The improvised shelter unrolls like a window shade and is fastened to the radiator cap, preventing rain from falling down the motorist's neck or onto the engine.

LIFE FOUND IN SOIL FROZEN 3,000 YEARS

ORGANISMS long buried in frozen soil have been found capable of life, according to Russian research workers who examined earth deposits in eastern Siberia. Samples of the frozen earth, taken from the bottom of a deep pit, were placed in distilled water and allowed to thaw. Later microscopic examination revealed the presence of living shrimplike shellfish like that pictured in the inset. The scientists' estimates indicate that these organisms have existed in the frozen ground, in a dormant state, for at least 3,000 years, and possibly much longer.



The Man



with the Net

SPIDERS found in India dive under water when frightened, and can stay beneath the surface for twenty minutes.

TAPIOCA is poisonous until it has been treated by a complicated heating process.

TELEPHONE BOOKS live only ninety-six hours in a corner cigar store in Times Square, New York. The directories are completely worn out every four days by the thousands of people using the public phones.



ICE FREEZES to a greater depth at zero than at lower temperatures.

SPEECH requires the simultaneous and coordinated use of seventy-two separate muscles.

OIL can spread into a film so thin that one ounce of the lubricant can be made to cover eight acres of water surface.



IRISH POTATOES are not Irish and are not potatoes. They are members of the nightshade family of plants and are related to the tomato. The sweet potato is the only true potato.

LIONS can be ordered by mail. A California animal farm will ship a healthy, "sweet-tempered" lion in response to a letter inclosing \$1,200.



DUST coming from outer space adds almost a pound an hour to the weight of the earth.

FROGS no larger than flies have been produced in the laboratory by feeding gland extract to tiny tadpoles.

VENOM extracted from bees is now being used to treat rheumatism.



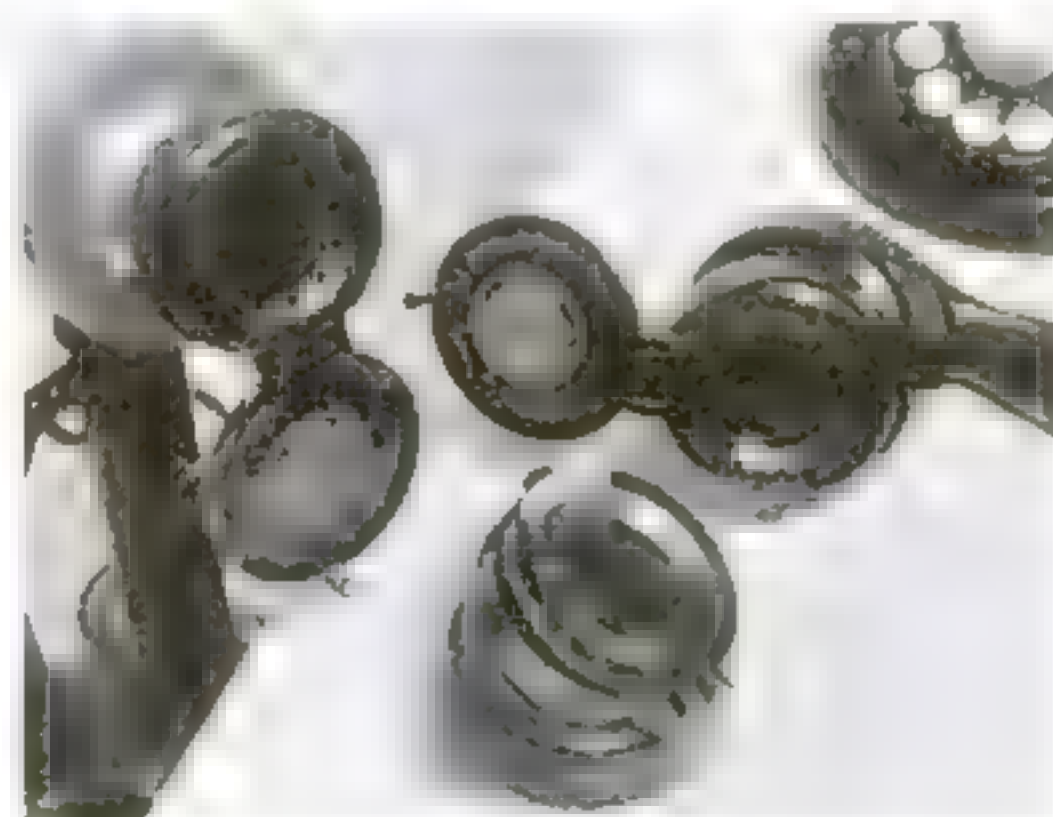
AIR PRESSURE RAISES AUTOMOBILE TOP

Below, a driver pulling a lever that releases air from a tank to raise the car top. Pressing a lever on the top, as at right, lets air out and the top comes down.



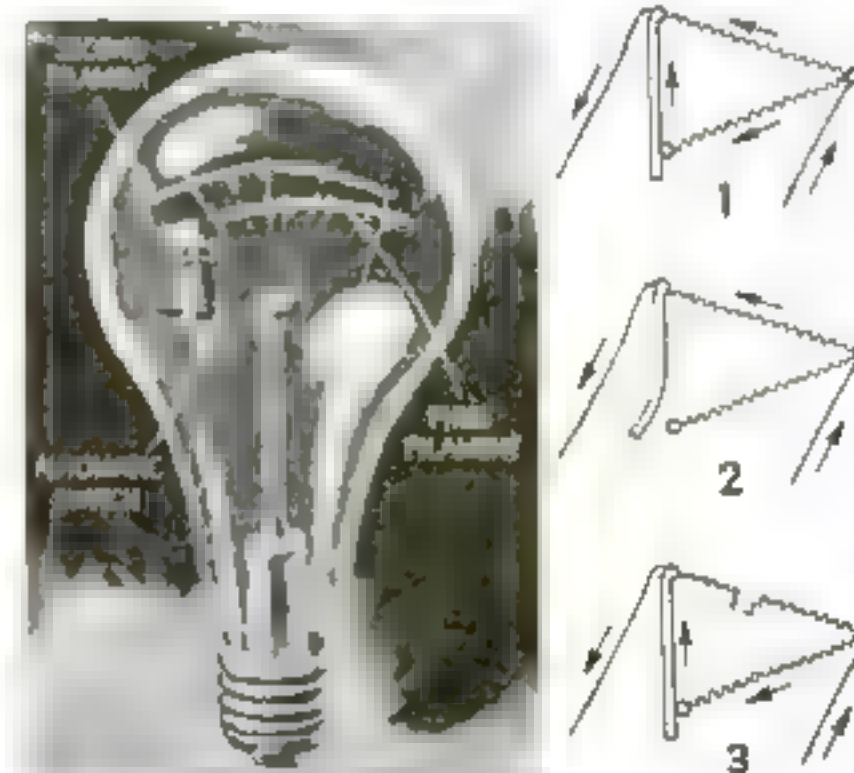
COMPRESSED AIR automatically opens and closes a new automobile top just introduced. To raise the top, the driver pulls a lever extending through the car floor board. Compressed air flows from a concealed tank and forces the top forward and upward into position. When a lever

on the underside of the top is pressed, the air pressure is released, and the top collapses and folds up. The air tank, when full, contains sufficient pressure to raise and lower the top fifteen times. It can be refilled at any gas station with the conventional air hose.



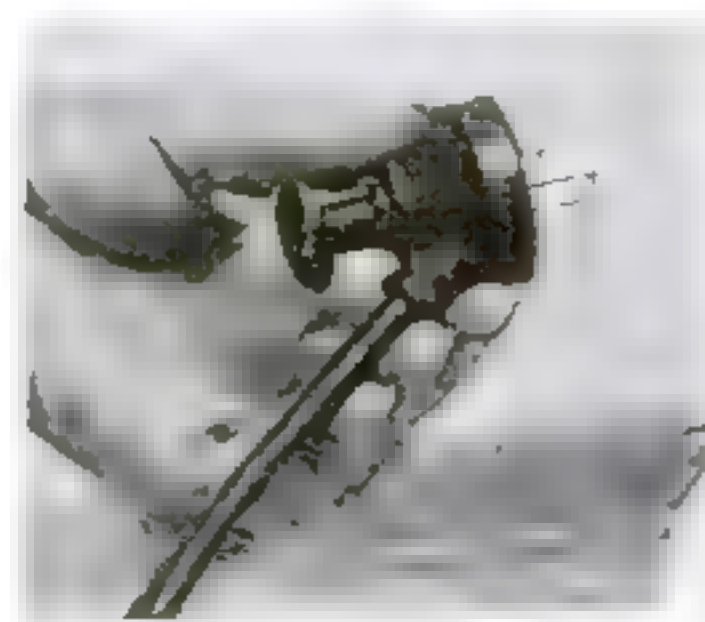
ELECTRIC-LIGHT BULB HAS SPARE FILAMENT

A new electric bulb fitted with two filaments instead of one is said to burn twice as long as conventional lamps. When the bulb is first lighted, current flows through both filaments until heat throws a thermostatic switch, as shown in diagrams 1 and 2 below. When one filament burns out, the switch automatically connects the second filament, thereby doubling the life of the bulb.



MOUTHPIECE COVER KEEPS PHONE FREE FROM GERMS

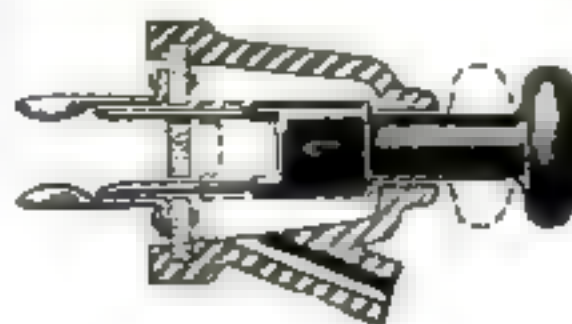
TELEPHONE mouthpieces are kept free from germs by a new accessory just marketed. A perforated unit fits over the phone mouthpiece and contains a cloth disk saturated with disinfectant, which is renewed every two months. When the phone is not in use, a hinged cover is kept closed, but can be flipped open quickly to permit normal phone conversation through the antiseptic cloth. The accessory is made in two styles, as shown above, to fit the two conventional types of telephones.



Novel electric plug, and how it works

PLUNGER LOCKS PLUG IN OUTLET

TIGHT electrical connections are assured by a new electric plug of novel design. When the plug is placed in an outlet, a rubber-tipped plunger is pushed inward, causing two metal strips to spread the contact prongs so that they grip the socket. Locked in place by the plunger, the plug is said to maintain a good connection even in cases where the outlets are worn or loose.



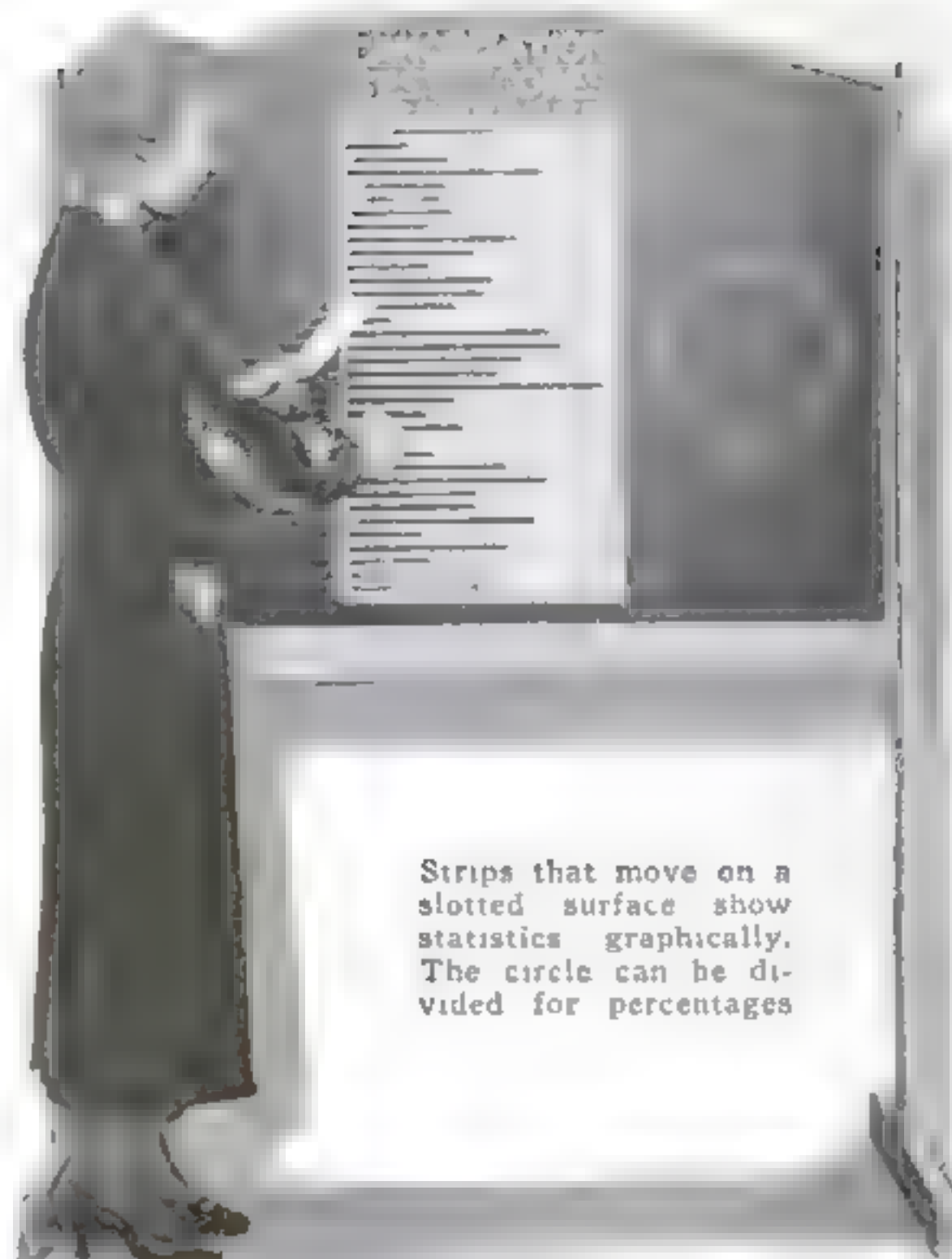
SUBMARINE CHARTS EARTH'S SHAPE

SEEKING to learn the exact shape of the earth, scientists of the U. S. Navy Hydrographic Office recently used the submarine *Barracuda* as a laboratory. Gravity measurements that they obtained in a cruise through the Caribbean Sea, coupled with earlier observations of the same type, may help solve outstanding problems of geology. The variations observed in the force of gravity at different points give clues to strains within the earth that cause earthquakes, create mountain ranges and ocean deeps, and distort the earth as a whole from the shape of a perfect sphere. At sea such readings can be obtained only aboard a submarine, since even the slight-

est surface swells make it impossible to operate the delicate instruments that are used. The observers on the *Barracuda* found it necessary to submerge to a depth of seventy-five feet to reach water quiet enough to operate their multiple-pendulum gravity apparatus, designed and built by a Dutch geologist, F. A. Vening Meinesz. During their 6,500-mile expedition they also took soundings of ocean depths, in a separate study covering a hitherto unexplored area of the floor of the sea.



The U. S. S. *Barracuda* at anchor. Fitted with delicate instruments, this submarine was used in underwater tests of variations in the force of gravity off the West Indian islands



Strips that move on a slotted surface show statistics graphically. The circle can be divided for percentages

MECHANICAL CLASSROOM GRAPH PRESENTS FIGURES VISUALLY

A MECHANICAL graph just introduced presents quantitative data to students in visual form. Set into a blackboard, a slotted surface is fitted with movable strips for indicating units of measurement graphically. A circle with calibrated edges can be used to represent percentages or time.

SPOONS LIFT ICE CUBES FROM TRAY TO DRINK

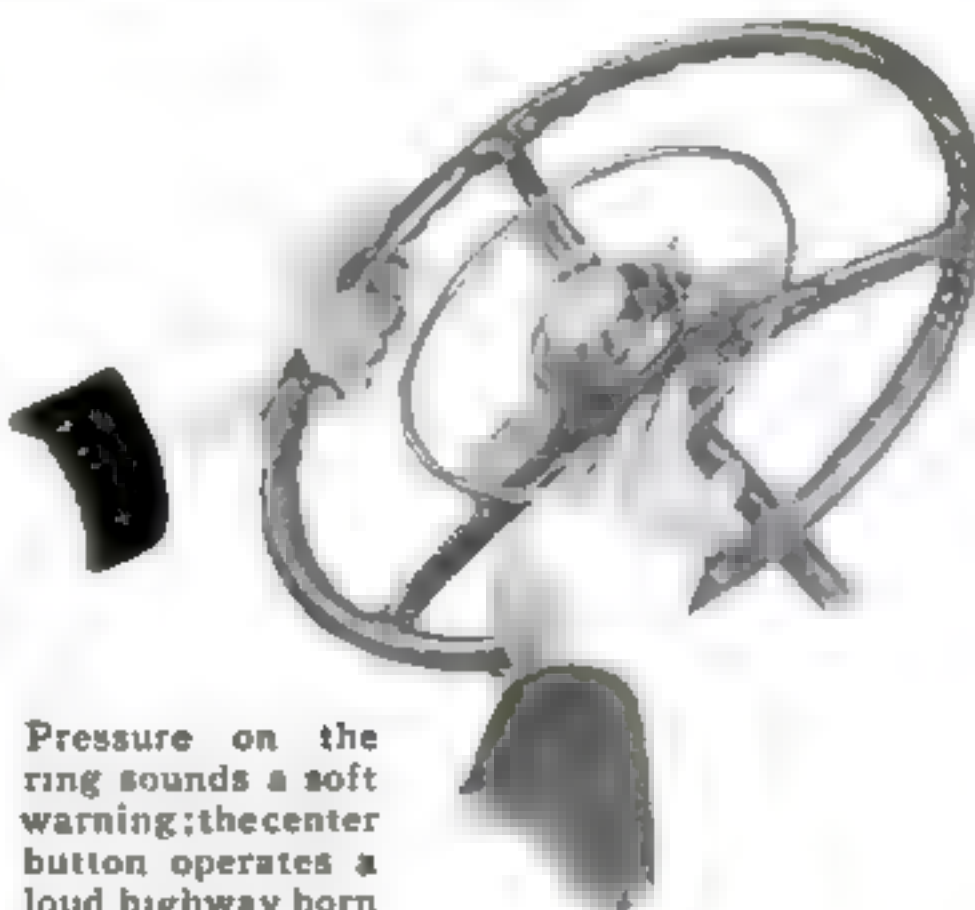
ICE-CUBE spoons which fit into a freezing tray for use in a mechanical refrigerator are a new household convenience. When a drink is to be iced, a spoon is lifted out of the tray by its handle and placed in the glass. In a few seconds, the ice cube melts enough to slip out of the spoon. The tray holds eight ice spoons, the handles being so shaped that they extend over the adjacent cubes for compactness.



Frozen to the spoon, an ice cube is placed in a glass. It soon melts enough to release the "spoon"

MIX SEAWEED IN CEMENT FOR BUILDING MATERIAL

HOUSES built of seaweed are a new possibility indicated by reports from Germany. It has been found that seaweed, mixed with cement, makes lightweight building blocks of good heat-insulating qualities. The same experimenters have found that peat, shavings, and sawdust, used in a similar manner, also have properties which make them valuable as building materials.



Pressure on the ring sounds a soft warning; the center button operates a loud highway horn

CAR UNIT SOUNDS HORNS AND CONTROLS SIGNALS

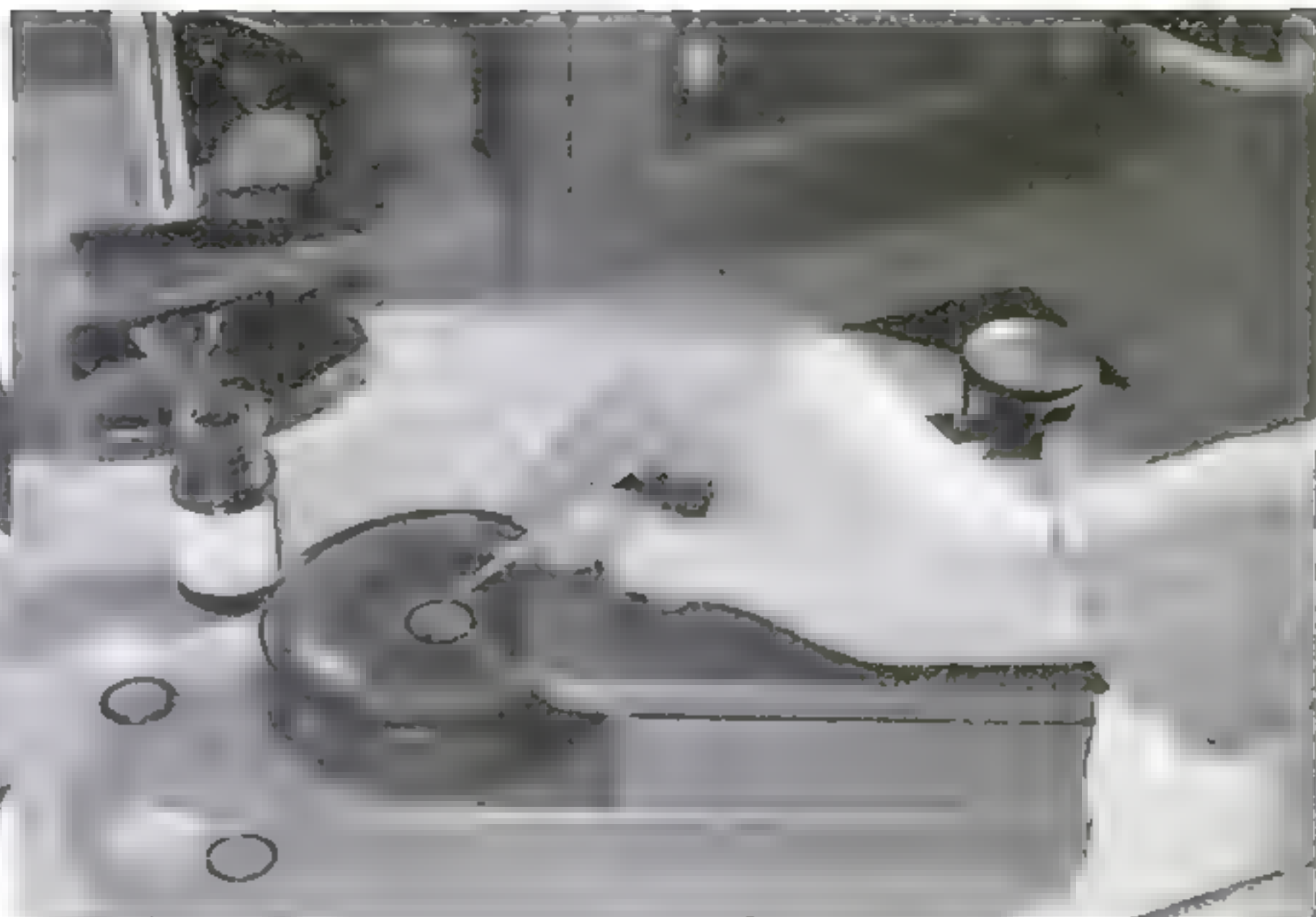
REPLACING the conventional horn-button unit, a new automobile accessory operates two horns and a signaling device. A metal ring within the steering wheel sounds one horn when touched at any point, while a central button operates an extra-loud horn for emergency use. Left and right turning signals on the rear of the car are controlled by a lever on the horn unit, while pilot lights beneath the transparent central button indicate whether the signal lights are on or off, to prevent their being left burning through carelessness.

TINY JAIL IS "BRIG" FOR BIGGEST BRIDGE

MOTORISTS who violate traffic regulations on the new San Francisco-Oakland Bay Bridge in California are locked up in a bridge prison which is one of the smallest jails in the world. Built into the administration building on the east approach to the bridge, the jail consists of only one cell, six feet square. Offenders are lodged in the tiny prison to await a hearing before a traffic-court magistrate, when such treatment is necessary.



The turntable disk rests on a roller-skate wheel, as shown below. The arm rest covers a storage space



A ring of shellac being built up on a microscope slide with the aid of the turntable. The disk is spun by hand, and shellac is applied with a small, artist's painting brush

Microscope Turntable

FOR MAKING SPECIMEN SLIDES

FEW pieces of auxiliary equipment will prove more valuable to you in your work with a microscope than a well-made turntable or "spinning wheel." With it you can quickly build up rings of shellac on microscope slides to provide cells for large specimens, or apply the circular seal of cement to hold a cover glass in place.

The usual type of spinning machine consists simply of a base on which is mounted a rotatable circular disk, or wheel, and a convenient hand rest. The top of the disk is provided with spring clips for holding a specimen slide. To make a cell, the operator clips a slide to the turntable, centering it accurately; dips a small, round, artist's brush in fairly thick shellac, gives the table a spin, and holds the brush tip so that it traces a ring on the rotating slide. Successive applications of shellac build the ring to any desired height. In a similar way, the turntable is used to produce neat rings around the edges of circular cover glasses, with asphalt varnish, shellac, or other sealing material.

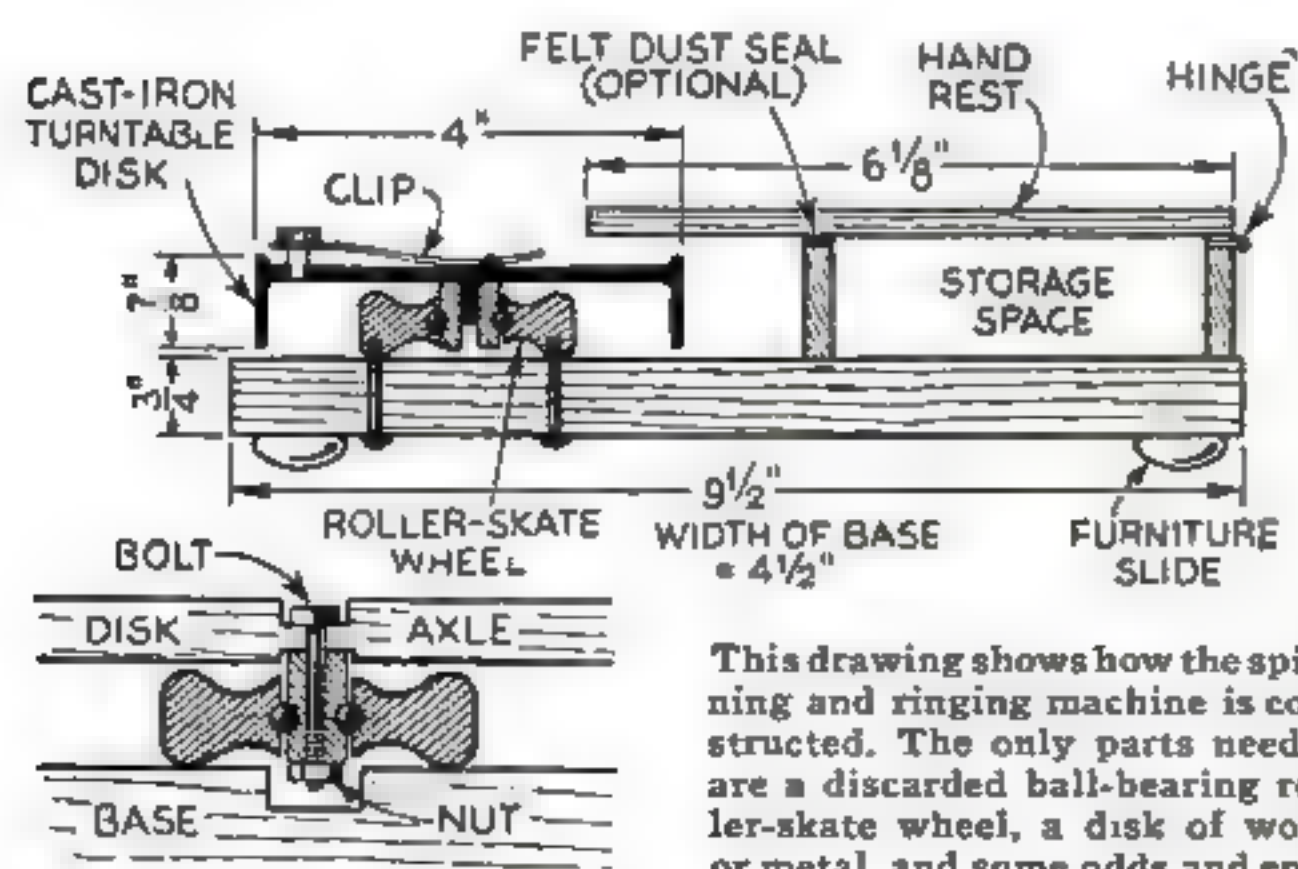
By Morton C. Walling

Although a variety of commercial turntables are available, the amateur microscopist can provide his home laboratory with a really professional model from a few odds and ends of wood and an ordinary ball-bearing, roller-skate wheel. First cut a base piece to the dimensions indicated in the drawings (a size to take a four-inch disk), and mount the skate wheel as shown. There are several ways of doing this. In the model illustrated, the wheel was drilled and tapped to receive two 6-32 machine screws that pass through the base piece. If the wheel axle does not clear the base piece when the wheel is resting on its side, a depression should be cut beneath it. The axle must rotate freely.

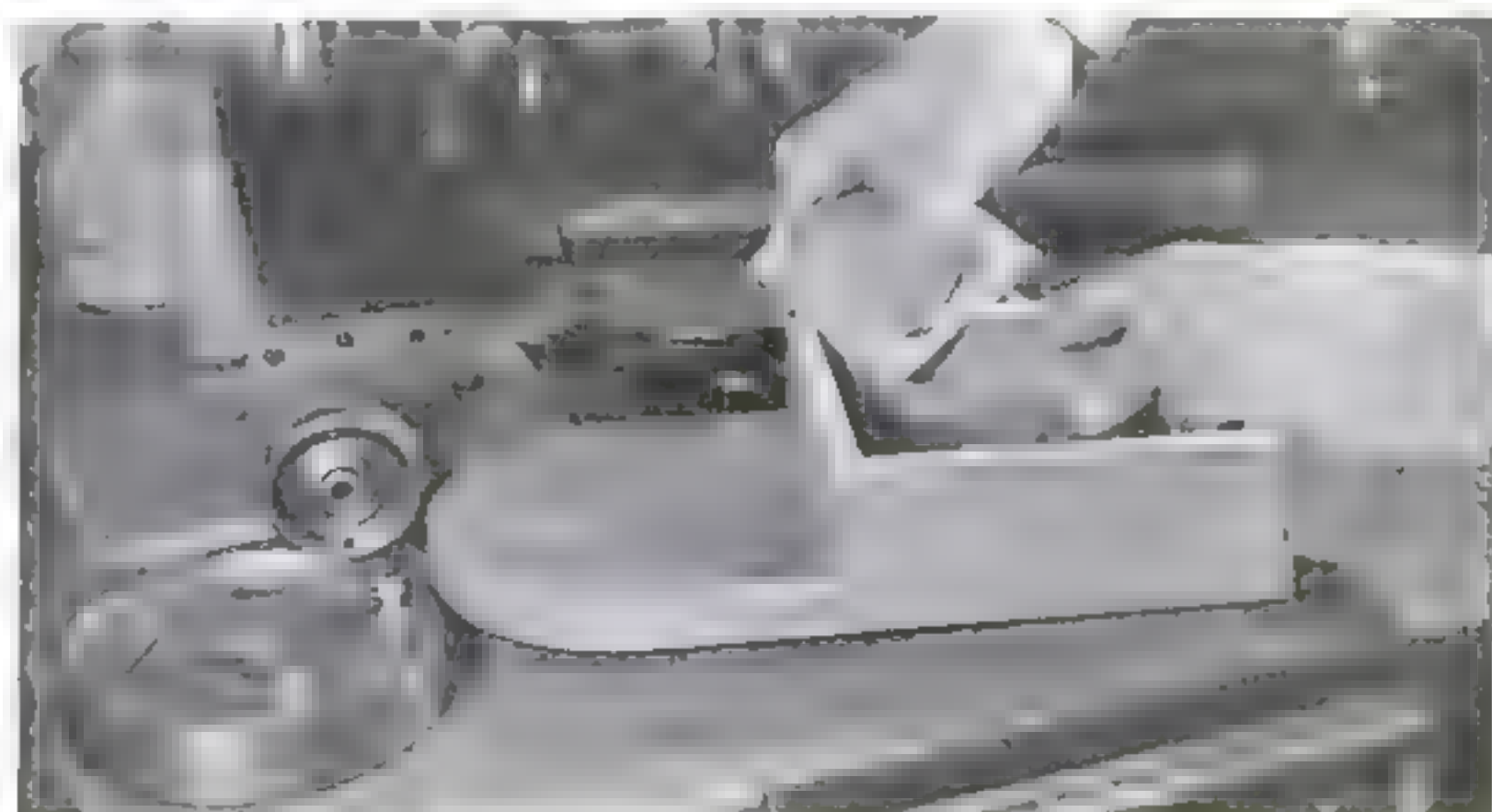
The turntable disk shown is made of cast iron, with a brass center pin that enters the quarter-inch hole in the skate-wheel axle. However, the disk can be made equally well of wood or plywood one-half to three-quarters of an inch thick. The

disk should run as true as it is possible to make it. If feasible, a lathe should be used in shaping it. On the top surface of the disk, mark the exact center, and several concentric rings about one-eighth of an inch apart, so that the slide can be centered easily. You can do this after the disk is in place. The clips used to hold the slide in place on the disk are similar to those used on microscope stages. They can be simple strips of springy metal or, as shown in the photograph, a pair of clips from the stage of a professional-type microscope.

The hand rest is a piece of plywood one quarter or three eighths of an inch thick, extending about halfway to the center of the disk. It must be supported high enough above the base piece to clear the clips. In the model shown, this support consists of a boxlike frame, made of $\frac{1}{4}$ by $1\frac{1}{4}$ -inch wood strips. The hand rest is hinged to the edge of the frame opposite the disk, thus forming a lid for a compartment in which spare slides, containers of shellac, and other supplies can be kept.



This drawing shows how the spinning and ringing machine is constructed. The only parts needed are a discarded ball-bearing roller-skate wheel, a disk of wood or metal, and some odds and ends

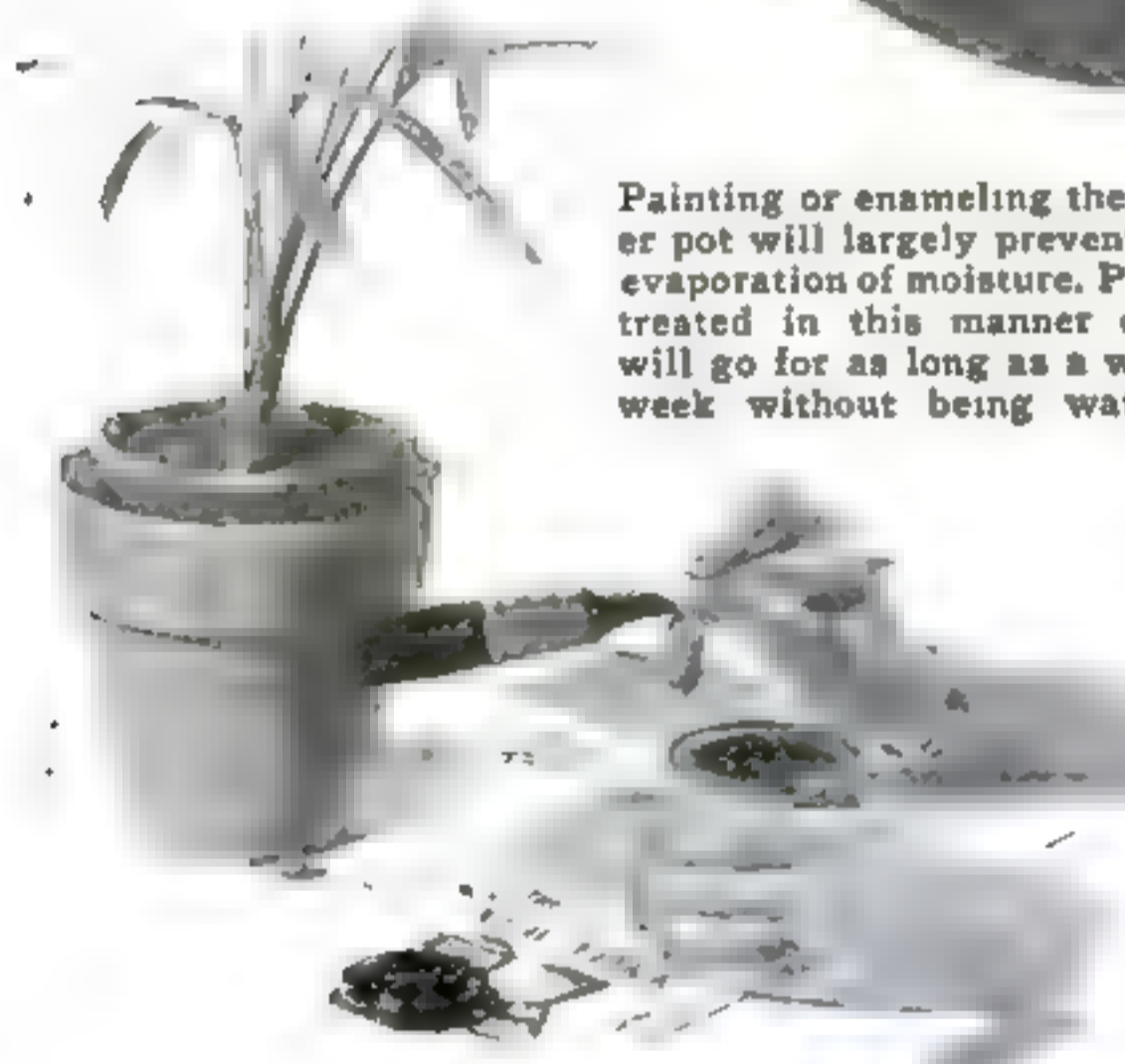


SIMPLE RULES THAT WILL HELP YOU GROW Better House Plants

Delicate plants, such as palms and ferns, can be kept from becoming too dry by double potting—that is, placing one pot inside another. The space between the pots should be packed with well-moistened peat moss. Then, whenever the plant is watered, the moss also should be given a little water. For a six-inch inner pot, an eight-inch pot is about right for use as the outside container



Plants grown in a window where they receive light from only one side tend to develop unevenly, because the cells farthest from the light grow more rapidly than those next to the window, causing the growing tips to bend toward the light. This condition can be corrected to some extent by turning the plants frequently



Painting or enameling the outer pot will largely prevent the evaporation of moisture. Palms treated in this manner often will go for as long as a whole week without being watered



Aphids (plant lice) and mealy bugs are among the most troublesome insects on house plants. An effective way to deal with these pests is to wash the stems and leaves frequently with soapy water, using a soft sponge or a swab of cotton, as shown at the left. Use plenty of good, mild, household soap. After washing, rinse off the leaves with some cool, clean water

As a general rule, good house plants can be grown in soil composed of a good garden loam to which have been added a little leaf mold or humus, a little rotted compost (manure), and a sprinkling of bone meal or complete fertilizer. These ingredients should be mixed thoroughly and screened as illustrated below



Daffodils grown from bulbs that have been kept in cool storage at around fifty degrees for about thirty days before planting, will come into bloom much earlier than those given the ordinary storage treatment

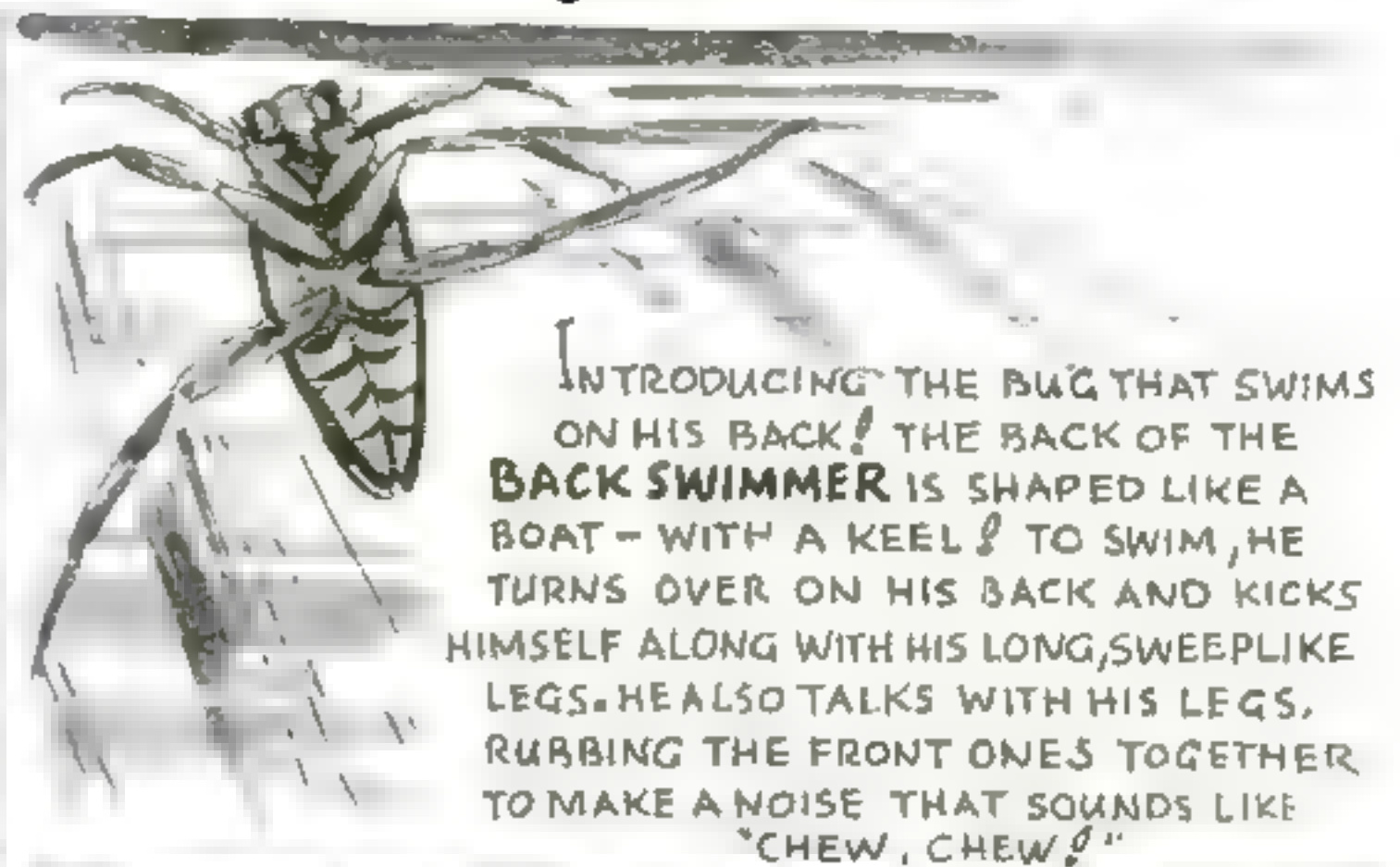
The blooming of certain plants, such as chrysanthemums, can be hastened by shortening the period of their exposure to daylight. Plants that are placed in a dark room at, say, four o'clock in the afternoon, and left there until nine in the morning, will bloom earlier. Other flowers need more light



Un-Natural History By GUS MAGER



MOTHER BLACK BEAR DESERVES CREDIT FOR INVENTING THE DAY NURSERY! WHEN SHE WANTS THE CHILDREN OFF HER HANDS FOR A WHILE, SHE JUST SENDS THEM UP A TREE. AND NOTHING WILL PERSUADE THEM TO COME DOWN AGAIN UNTIL SHE CALLS THEM!

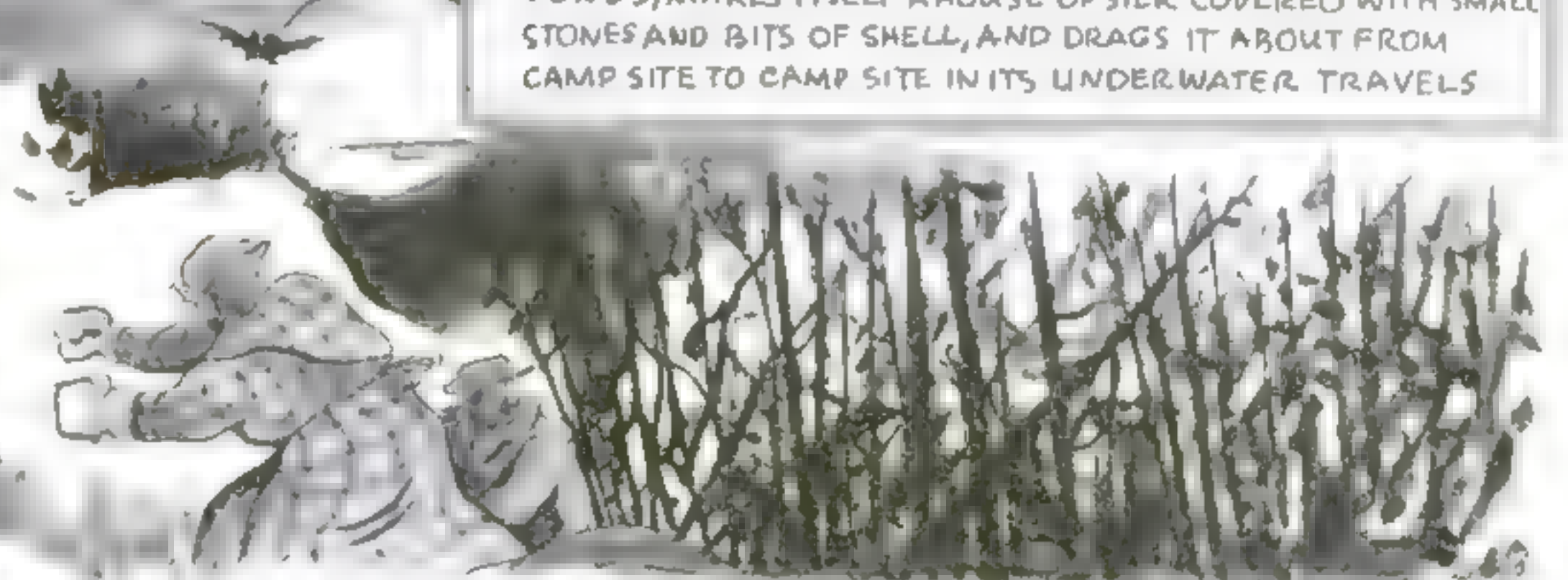


INTRODUCING THE BUG THAT SWIMS ON HIS BACK! THE BACK OF THE **BACK SWIMMER** IS SHAPED LIKE A BOAT - WITH A KEEL! TO SWIM, HE TURNS OVER ON HIS BACK AND KICKS HIMSELF ALONG WITH HIS LONG, SWEET-LOOKING LEGS. HE ALSO TALKS WITH HIS LEGS, RUBBING THE FRONT ONES TOGETHER TO MAKE A NOISE THAT SOUNDS LIKE "CHEW, CHEW!"

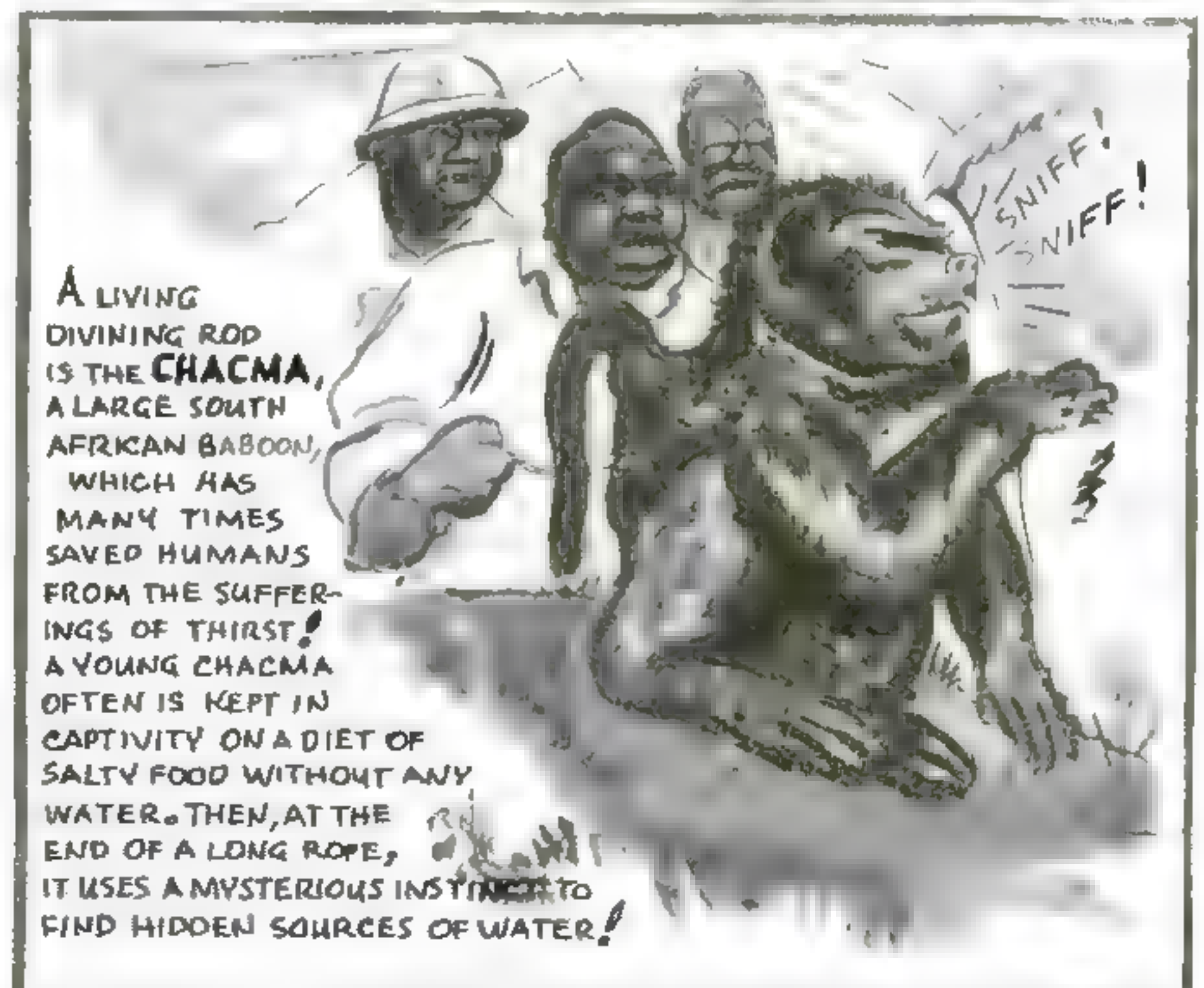


AND HERE, FOLKS, IS THE ORIGINAL TRAILER! THE **CADDIS FLY** LARVA, FOUND IN OUR BROOKS AND PONDS, MAKES ITSELF A HOUSE OF SILK COVERED WITH SMALL STONES AND BITS OF SHELL, AND DRAGS IT ABOUT FROM CAMP SITE TO CAMP SITE IN ITS UNDERWATER TRAVELS

NATIVES OF THE FAR NORTH HAVE A SUPERSTITIOUS FEAR OF THE **GRAY OR JACK PINE**, WHICH GROWS IN SCRAGGLY CLUSTERS ON THE BARRENS AND IN GLOOMY BOGS. IT IS BELIEVED TO POISON EVEN THE GROUND THAT IT SHADOWS, AND LEGENDS SAY THAT CATTLE GRAZING NEAR IT ARE FATALLY STRICKEN!



BECAUSE THE LARVA OF THE **LACEWING FLY** IS A CANNIBAL, THE CLEVER MOTHER FLY SPINS STIFF, SILK STALKS AND STICKS AN EGG ON THE END OF EACH. WHEN THE YOUNGSTERS HATCH AND DROP TO THE LEAF BELOW, THEY CAN'T EAT THEIR UNHATCHED BROTHERS AND SISTERS FOR BREAKFAST!



A LIVING DIVINING ROD IS THE **CHACMA**, A LARGE SOUTH AFRICAN BABOON, WHICH HAS MANY TIMES SAVED HUMANS FROM THE SUFFERINGS OF THIRST! A YOUNG CHACMA OFTEN IS KEPT IN CAPTIVITY ON A DIET OF SALTY FOOD WITHOUT ANY WATER. THEN, AT THE END OF A LONG ROPE, IT USES A MYSTERIOUS INSTINCT TO FIND HIDDEN SOURCES OF WATER!

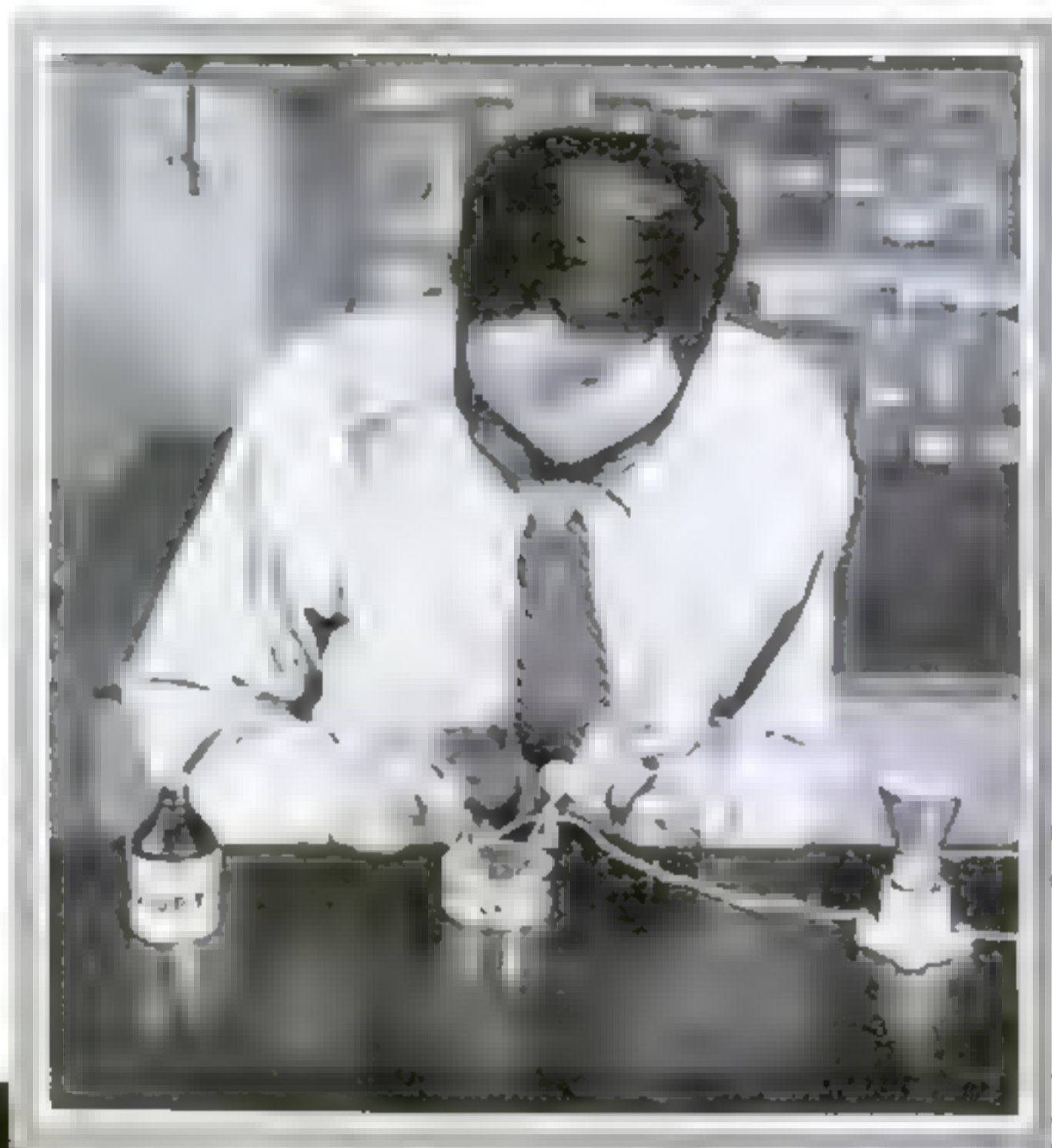
Home Tests

SHOW HOW

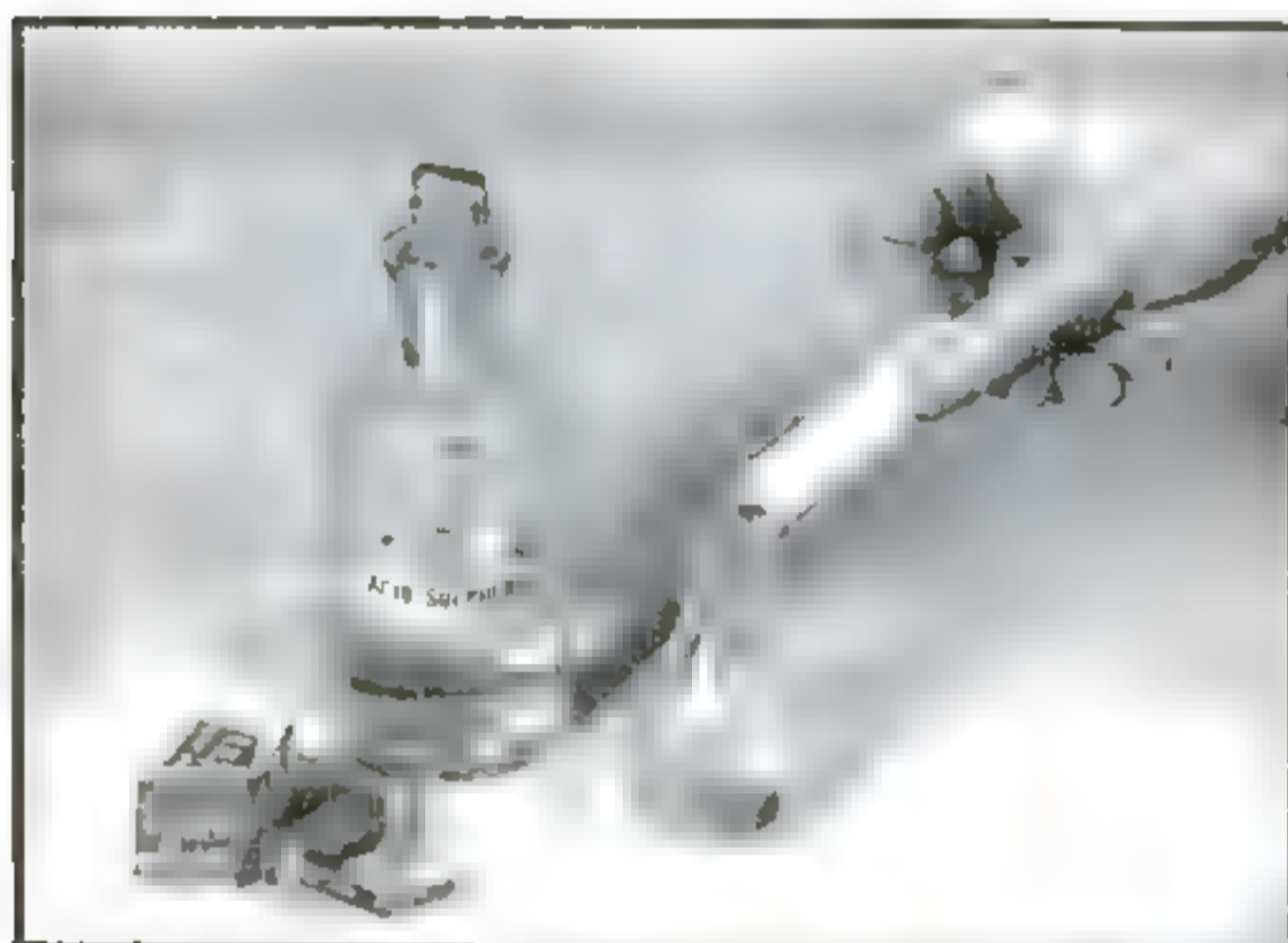
Aluminum

GIVES US

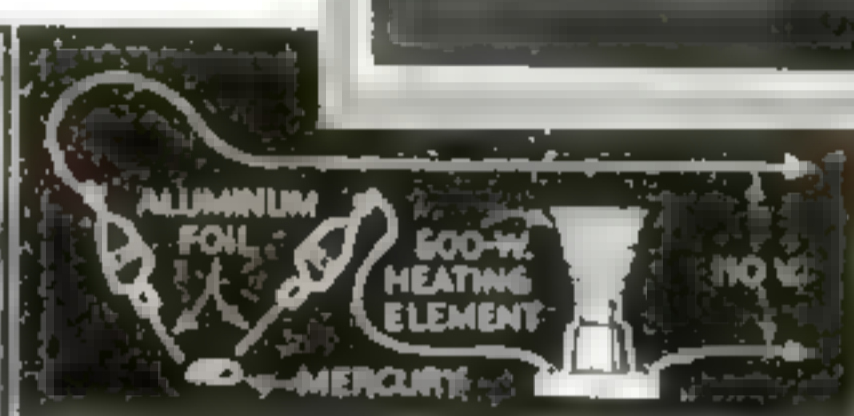
DYES and PAINTS



The electrical method of making aluminum amalgam by creating arcs between aluminum-foil electrodes and a drop of mercury. It is advisable to wear tinted goggles, to protect the eyes against glare



Paper impregnated with lead acetate reveals the presence of sulphur in ordinary laundry "bluing"



household laundry bluing and in blue paints, is an exception. Artists once ground up the rare mineral lapis lazuli to obtain it. Nowadays it is made synthetically. It contains aluminum in combination with silicon and other substances. You can prepare it on a small scale, using for ingredients about ten parts of kaolin (the white clay used in making porcelain), ten parts of sodium carbonate, and five or six parts of sulphur. Put the mixture in a porcelain crucible, cover it with a bit of charcoal, and set the lid of the crucible in place. Heat the contents with a Bunsen-burner flame for fifteen minutes. Then pour out the mixture into a flask and boil it with some potassium sulphide solution. This brings out the blue color. The kaolin used in this experiment, which supplies the aluminum, is known also as China clay, and may be obtained from chemical supply houses and from many drug stores. The potassium sulphide often goes by the name of liver of sulphur.

The "bluing" you have made contains sulphur in the sulphide form, as you can easily show by dropping some acid upon a fragment of it. You will instantly notice the foul odor of hydrogen sulphide gas, liberated from the sulphide by the acid (P.S.M., Jan. '36, p.54). If you moisten a piece of paper with lead acetate or lead nitrate solution, and hold the strip near the acid-treated bluing, the paper will turn brown or black, because of the formation of lead sulphide.

You can try out a peculiar method of waterproofing fabrics, in which aluminum plays a part, by mixing a solution of aluminum sulphate with one of lead acetate. The heavy, white precipitate of lead sulphate that settles from the liquid is not concerned in the experiment. The clear liquid remaining contains aluminum acetate. When cloth is dipped in this solution, the aluminum compound soaks into the fibers. It turns into aluminum hydrox-

TO PERFORM a variety of entertaining experiments with aluminum and its compounds, an amateur chemist need not look far for materials. The kitchen yields the metal in the form of old pots and pans and their lids; spoons, tea balls, and salt and pepper shakers. Powdered aluminum, sold for use in paint, provides another source of supply. Aluminum sulphate is familiar to scientific gardeners, for this compound of aluminum is commonly used to counteract excessive alkalinity of the soil. Alum from the household medicine chest—a compound chemically known as potassium aluminum sulphate—can be used directly in some experiments, and also will enable you to manufacture aluminum salts that you otherwise would have to purchase.

Dissolve some of the alum in water and add sodium hydroxide or ammonium hydroxide solution to it. Household lye or ammonia will serve the purpose. The jellylike precipitate that is formed consists of aluminum hydroxide. Wash it by decantation—that is, let it settle, pour off the clear upper liquid, add fresh water, and shake, repeating the process several times. Then strain out the precipitate. It must be filtered from the liquid with a cloth, as water would drain off from it too slowly through filter paper. Now you can prepare other compounds of aluminum at will, by



A FEATHERED TEA BALL

After dipping in mercuric chloride, a discarded aluminum tea ball sprouts tendrils of alumina

dissolving the paste in various acids. For aluminum sulphate, sulphuric acid is used; for aluminum chloride, hydrochloric acid; and so on. If you heat aluminum hydroxide strongly you will get aluminum oxide, also known as alumina.

Many metals yield colorful sulphides when hydrogen sulphide gas bubbles through solutions of their salts. Aluminum sulphide, however, interacts with water and decomposes as fast as it forms, producing aluminum hydroxide. Most of the compounds of aluminum are white, like this one.

Ultramarine, familiar as a pigment in

By
RAYMOND B. WAILES

ide by interaction with moisture, and impregnates the fabric. In drying, the cloth becomes so water-repellent that it can be wet only by the most strenuous efforts.

Artificial coloring for aluminum articles is a recent development, and you can duplicate this interesting process in your home laboratory. The secret lies in forming a coating of aluminum oxide upon the metal and then impregnating the oxide, which acts as a sort of adhesive, with a dye or a chemically produced pigment.

Boil an aluminum object or a strip of the metal in a solution of sodium or potassium dichromate and sodium carbonate. This will produce the desired coating of oxide. Then wash it, and it will take on the chosen tint when it is immersed in a dye solution. The film of aluminum oxide "adsorbs" or takes up the dye so that the metal itself appears colored. A yellow hue may be obtained without recourse to a dye, by immersing the oxide-coated aluminum first in a lead acetate solution and then, without washing, in a solution of sodium or potassium chromate. This precipitates a yellow chemical pigment, lead chromate, in the oxidized coating.

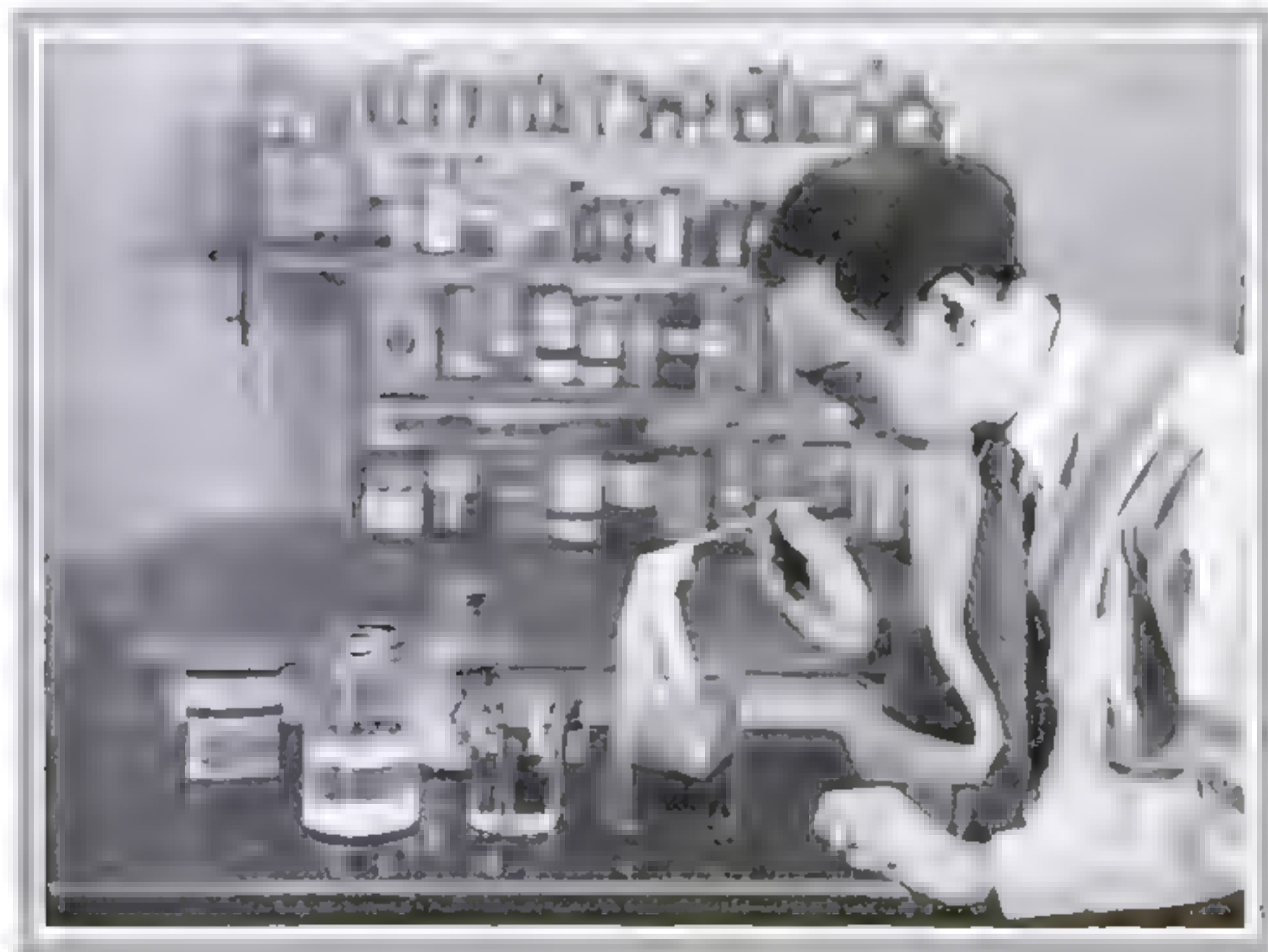
Another process, now employed commercially, forms the aluminum oxide electrically. The article to be colored is placed in a twenty-five percent solution of sulphuric acid and connected to the positive terminal of a source of direct current. If the tank containing the acid bath is of lead, it is connected to the negative terminal; otherwise, a strip of lead immersed in the acid serves as the negative electrode. Within certain limits of temperature and current strength, the coating of oxide is produced, and then is dyed or otherwise colored as before.

Making colors adhere to aluminum with

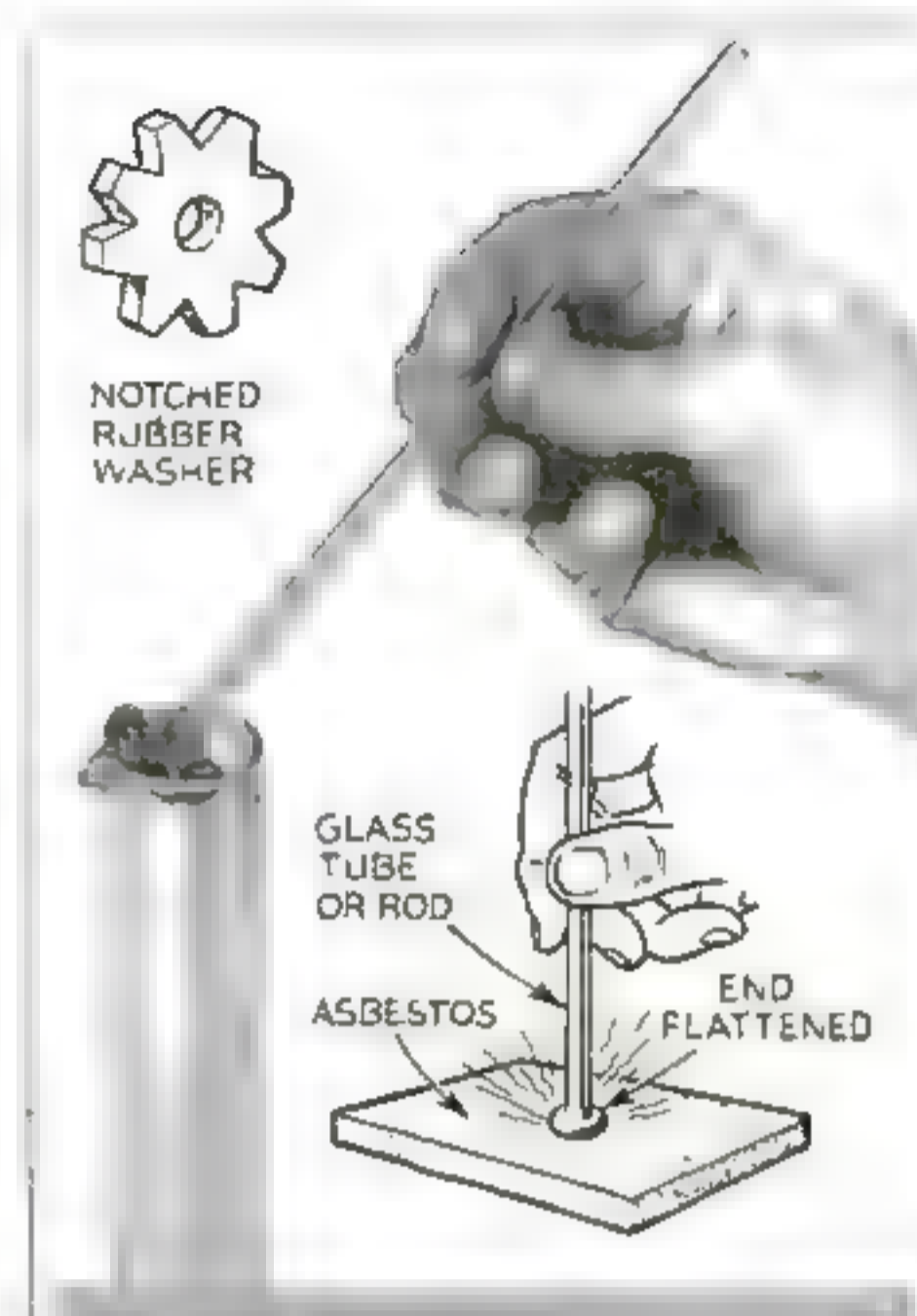
the aid of its oxide recalls the common use of aluminum compounds as "mordants" to assist in dyeing cloth. In this case, aluminum hydroxide is the compound employed. To demonstrate its affinity for coloring matter, dissolve some Congo red dye (obtainable from dealers in chemical supplies) in about 300 cubic centimeters, or roughly ten fluid ounces, of water. Add aluminum hydroxide to the dye solution and boil the liquid for several minutes, swirling it about in the beaker or flask every minute or so. Now pour the liquid into a piece of filter paper folded in a funnel. The filtrate, or liquid that passes through the filter, will be clear, showing that the dye has been "adsorbed" by the aluminum hydroxide remaining on the filter paper. Almost any other dye solutions, such as colored inks that you may have about the house, will give the same result, and you will find it interesting to try them. A quantity of aluminum hydroxide sufficient for this experiment can be prepared by adding ammonium hydroxide to about ten grams (two teaspoonfuls) of alum dissolved in water. The precipitate should be washed by decantation, as explained in an earlier paragraph, before you use it.

BY COMPARING the effects of various dyes on untreated cloth and the "waterproofed" cloth that you prepared in another experiment, you can observe the part that aluminum hydroxide plays as a mordant in actual dyeing. Dyes that have no effect on the plain cloth will effectively color the piece impregnated with aluminum hydroxide. Another way to prepare cloth for this dyeing test is to dip a piece of white fabric first in aluminum sulphate or alum solution, and then in dilute ammonium hydroxide, to precipitate

Compounds of This Interesting Metal Have a Part In the Waterproofing and "Mordanting" of Fabrics, As Well As in the Manufacture of Many Pigments



To illustrate the use of aluminum compounds as "mordants" to aid in dyeing cloth, a piece of white fabric is dipped in solutions that precipitate aluminum hydroxide in its fibers



Acidproof Stirring Rod

WHEN measured-out quantities of two liquids are to be mixed right in the graduate, the simple acidproof stirring rod shown above will come in handy. Its shape particularly adapts it for use with the cylindrical measuring vessels commonly employed in chemical laboratories. To flatten the tip of the glass tube or rod into a seat for the notched rubber disk, heat it red-hot, and press it against a sheet of asbestos. Then rotate the glass again above the burner, meanwhile cutting down the flame until it is very small. Finally, continue heating for several minutes over the yellow gas flame. This anneals the glass and prevents it from cracking.

the aluminum hydroxide in its fibers.

Powdered aluminum, sold for use with a varnish as aluminum paint, gives a dazzling white light when it is blown into a Bunsen-burner flame. The metallic powder liberates hydrogen when it is heated with sodium hydroxide solution, providing a convenient laboratory supply of the gas. By mixing finely divided aluminum with powdered magnetite or magnetic (ferric) oxide, the welding preparation known as thermite is obtained. Ignite it in a crucible, and the aluminum combines with the oxygen of the iron oxide and leaves the iron. So much heat is generated in the showy reaction, one of the most spectacular in chemistry, that sparks of molten iron fly from the white-hot mixture and soar through the air like meteors. After the experiment, a button of solidified iron is found in the crucible.

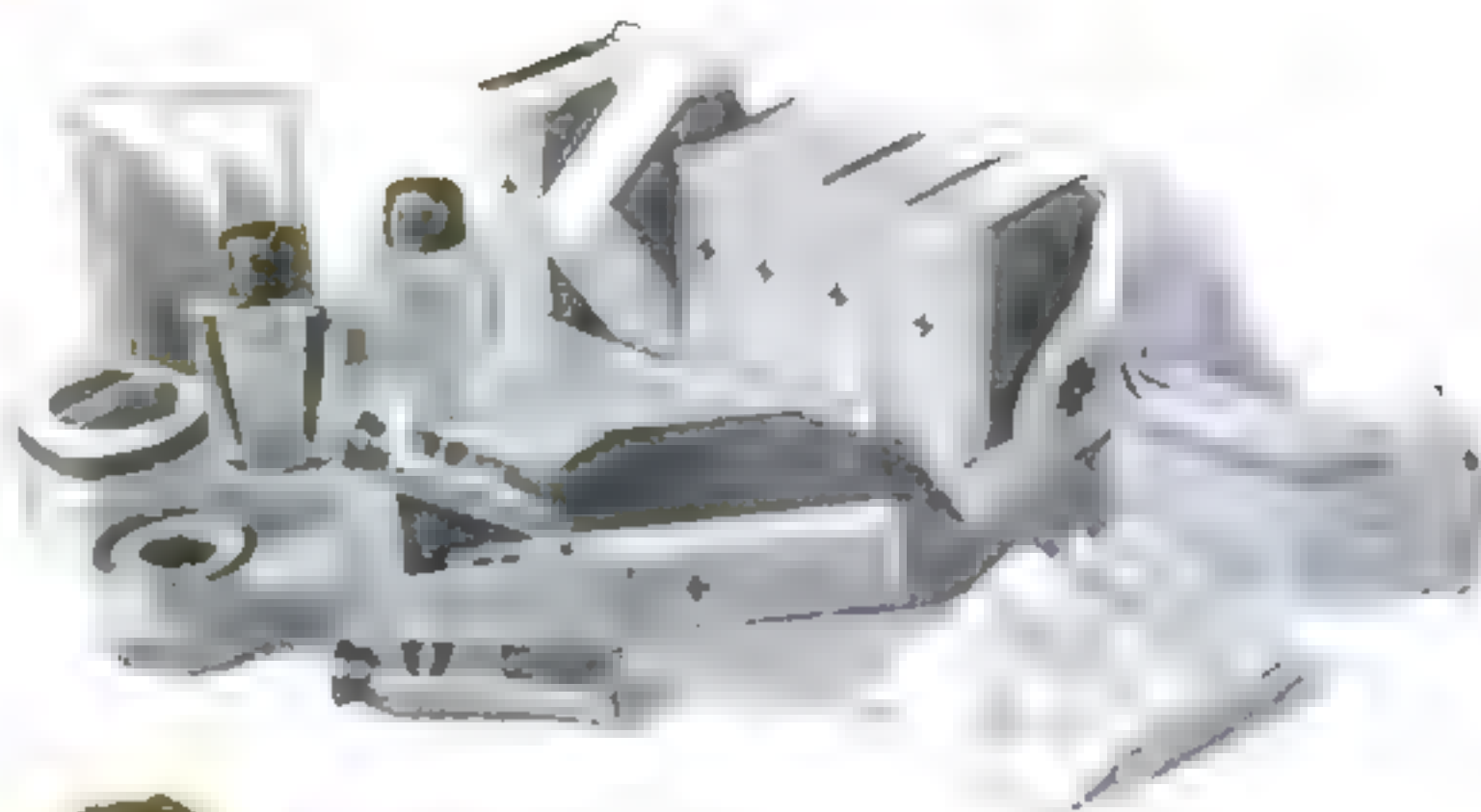
Neither a match nor the flame of a Bunsen burner gives enough concentrated heat to touch off the thermite mixture. A small heap of a starting preparation must be placed on top of the chemicals and ignited. This may consist of equal parts by weight of potassium chlorate and sulphur. Another formula uses two parts of aluminum powder, two parts of potassium perchlorate, and one part of flowers of sulphur, also measured by weight. Do not use potassium chlorate in the latter preparation, as it *(Continued on page 128)*

HOMEMAKERS' TASKS
MADE EASIER BY NEW

Household Utilities



DESK TURNS INTO BAR
From an innocent-looking knee-hole desk, as shown in the inset, this handy little piece of furniture is readily transformed into a complete home bar, with space for glasses and all other necessary equipment. The desk top folds back



FIRST-AID "BOOKSHELF." Resembling a set of small books, a handy first-aid kit contains everything necessary for emergencies in the home. A booklet included in the kit gives timely instruction in the use of the materials



SINK STRAINER. A double-acting hinge on the sink strainer pictured above permits the cover to be turned under the bowl, serving as a tray to prevent dripping of moisture as waste is removed from the sink



TRIPLE SIFTER

Because it has three screens and three agitators, a new flour sifter gives a triple sift in one operation. As shown at the right, the three sifting units are mounted on a single shaft and the device is easy to clean



RACK PICKS OUT A TIE FOR YOU. With a new tie rack now available, you can't go wrong in selecting a tie of the right color to go with your suit and shirt. A style chart at the top of the frame has a revolving dial that shows the correct color combinations, the legends appearing under windows in the frame as a knob is turned. The rack is made to accommodate thirty-two neckties



PAPER CURTAINS. Made of a cellulose fiber developed specially for the purpose, these paper curtains are said to resist shrinking, moisture, and fading. They come in many styles

LIFTER FOR IRON IS AUTOMATIC. With the attachment illustrated at the right, which can be fitted to almost any electric iron, it is impossible for a careless person to leave a hot iron on a garment. While the iron is in use, a spring lever is held down with the thumb, and this holds the lifter legs up at the side of the iron where they are out of the way. When the lever is released, as it must be whenever the hand is taken off the iron, the legs spring down and lift the iron safely above the board. In addition to its value as a safety feature, the lifter of course saves the labor usually expended in shifting the iron to its metal stand.



TABLE GRILL. Steaks, chops, and other substantial dishes are cooked right on the dinner plates with this new electric table grill. Made of a specially hardened porcelain that resists heat, it harmonizes with other table fittings and is easy to clean.



GRATES ICE
In addition to many uses in straining, shredding, and grating food, the handy appliance shown at the left produces finely grated ice. Built like a meat grinder, it has a conical screen with fine perforations to shred the ice cubes.

VINEGAR BOTTLE MAKES ROLLING PIN

After using the vinegar that comes in the novel container pictured at the right, a housewife can employ the bottle as a rolling pin. Filled with cold water or cracked ice, it provides the "cold rolling" that is preferred by many for making pie crust flaky.

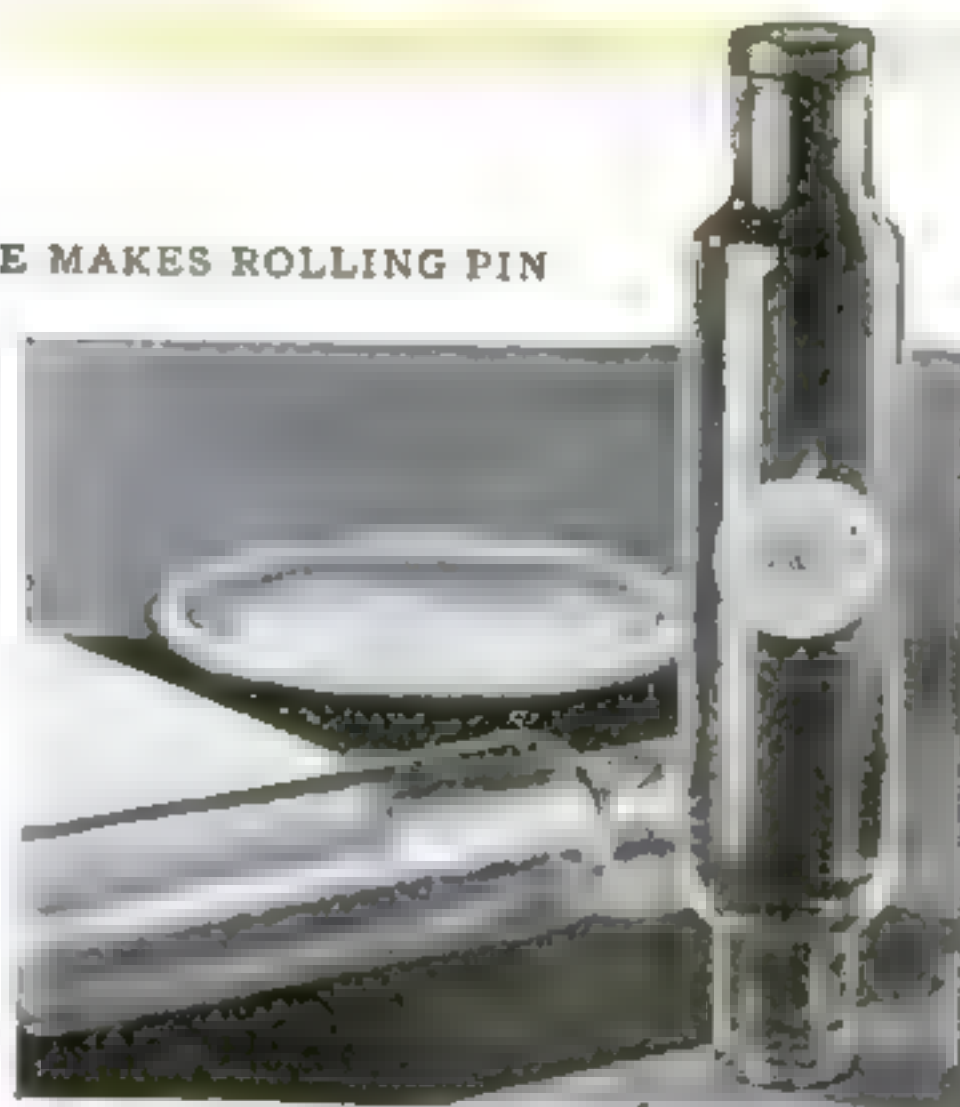


TABLE SERVES FOR DINING OR BILLIARDS. With the versatile fixture shown, it is possible to enjoy a game of pocket billiards on the dining table. Hinged leaves swing down at the table sides to expose the playing surface.



HANDLE FOR VACUUM BOTTLE
Available in sizes to fit all vacuum bottles, this convenient handle has a clamping band that fastens around the container. A swivel arrangement makes it serve both as a vertical bail when the bottle is carried, and as a handle for pouring, as shown in the pictures.

Illusion Puts Candle in Bottle of Water

A CANDLE apparently burning inside a bottle of water is an illusion that is sure to startle your friends. As shown in the photograph at the right, the candle actually is hidden from the observer by a book set up on edge, while a pane of glass is placed between it and the milk bottle full of water. The illusion is due to the fact that glass both transmits and reflects light, so that the eye sees the reflected image of the candle imposed on the transmitted image of the bottle. This principle is used in many stage illusions, and you can apply it in a number of ways to create mystifying effects for the amusement of your guests.



Stunts for Home Scientists

Patterns of Sand Illustrate Theory of Lenses

A PAIR of toy wheels rolled down an incline onto salt or sand arranged in the form of the cross section of an optical lens, behaves just as a ray of light would do on striking a lens of that shape. If it strikes the center of the "lens," it goes straight on; if it strikes the side of a convex pattern, it is deflected toward the center; the side of a concave shape turns it outward, as a lens of that type would do to rays of light.

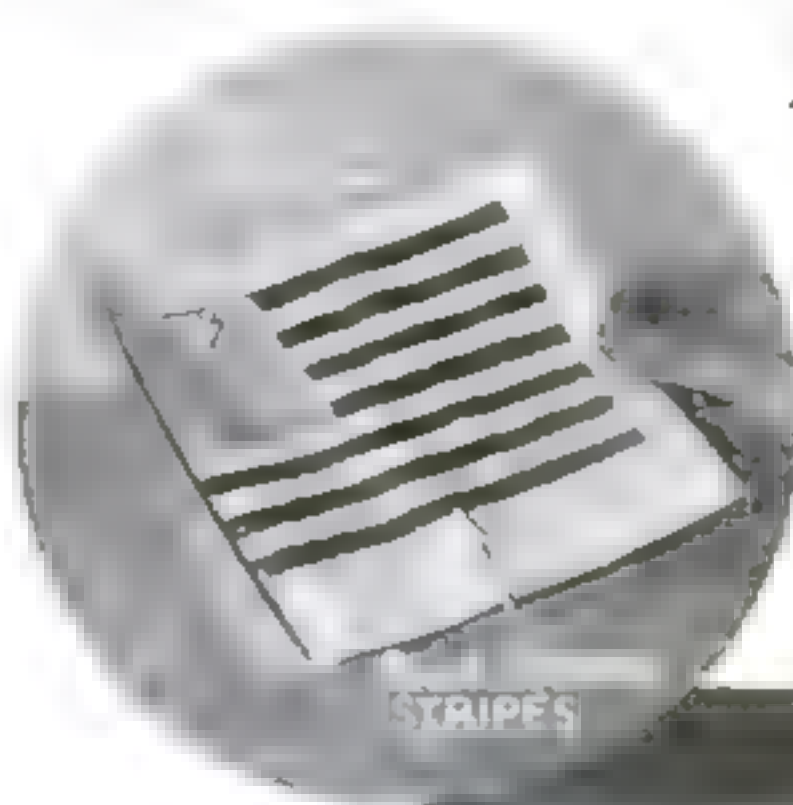


Burned-Out Bulb Shows Action of Electrolysis

ELECTROLYSIS, or the decomposition of chemical compounds by an electric current, can be demonstrated with a burned-out light bulb. Make a hole in the end of the bulb by holding it at the tip of a pointed flame, and fill it with a solution of common salt. Then wire the bulb to several dry cells connected in series. Hydrogen will be given off at the end of the filament connected to the negative pole of the battery, and chlorine at the other (or oxygen, if the solution is a weak one).

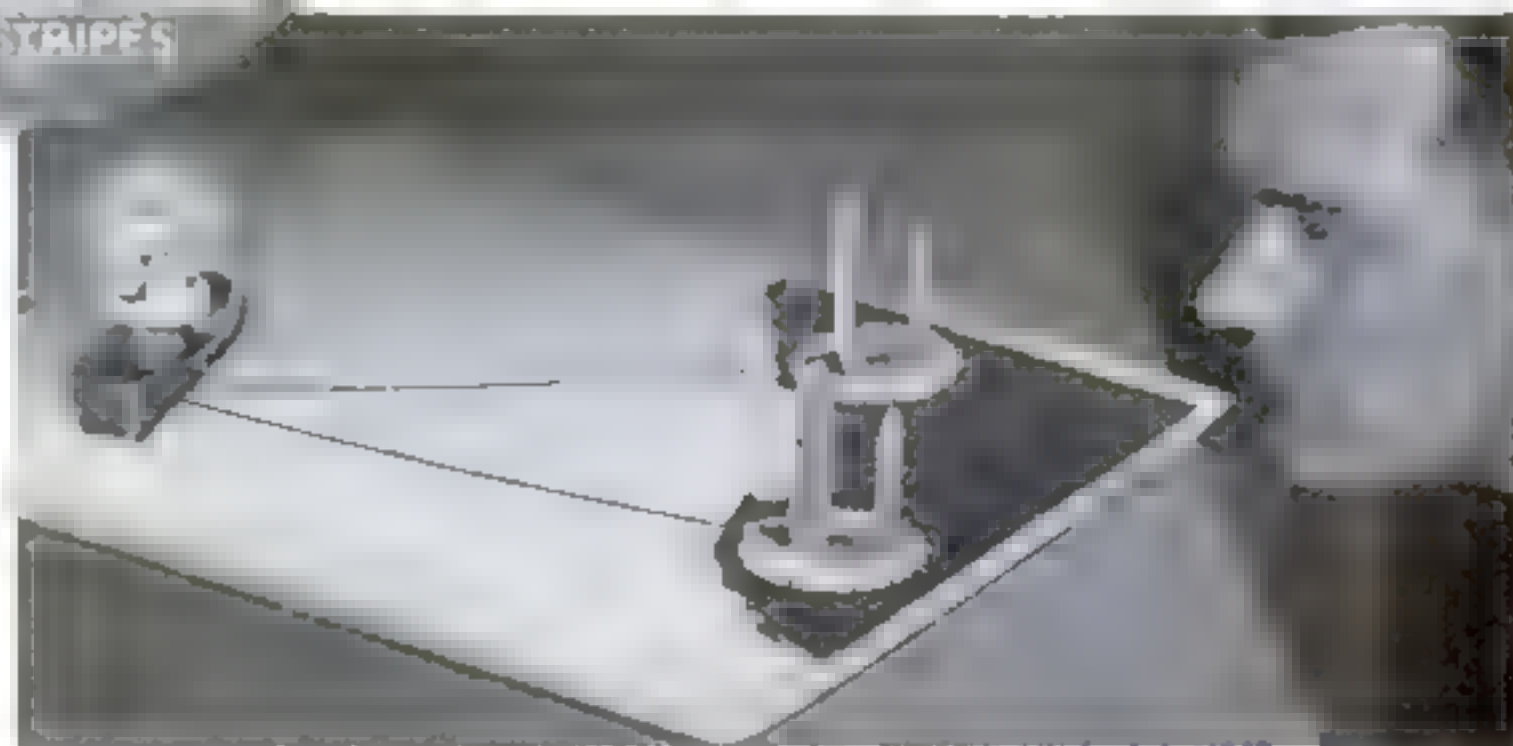
Fatigue Gives Color Reaction

PAINT an off-color American flag with oil or water colors, making the stripes blue-green and the field a brilliant orange-yellow. Stare at this flag steadily for a minute or more, and then quickly transfer your gaze to a sheet of white paper. In a few seconds, you will seem to see another flag, but this time in the familiar red, white, and blue! "Color fatigue" makes the complementary colors appear.



Magnetic Repulsion Makes Coil Defy Gravity

WIND the end of an annealed-iron bolt with a hundred or so turns of insulated wire. From similar wire, wind another coil of a dozen turns so that it will fit loosely over the bolt. Now, connect the first coil to your 110-volt, alternating-current house circuit, in series with a heater unit or some similar resistance. When the bolt is held upright and the circuit completed, the smaller coil will be repelled and will remain suspended above the other. This is due to induced current.



How Radio-Compass Stations Work

WITH the simple set-up shown in the photograph, you can illustrate the principle by which radio-compass stations find the position of a ship in distress. The sights, representing directional receiving aerials, are turned until each points at the flash-light bulb mounted on the make-believe vessel. It is then easy to construct a triangle of which two angles and one side (the distance between the two "stations") are known, and the ship's position is at the opposite apex of the triangle.

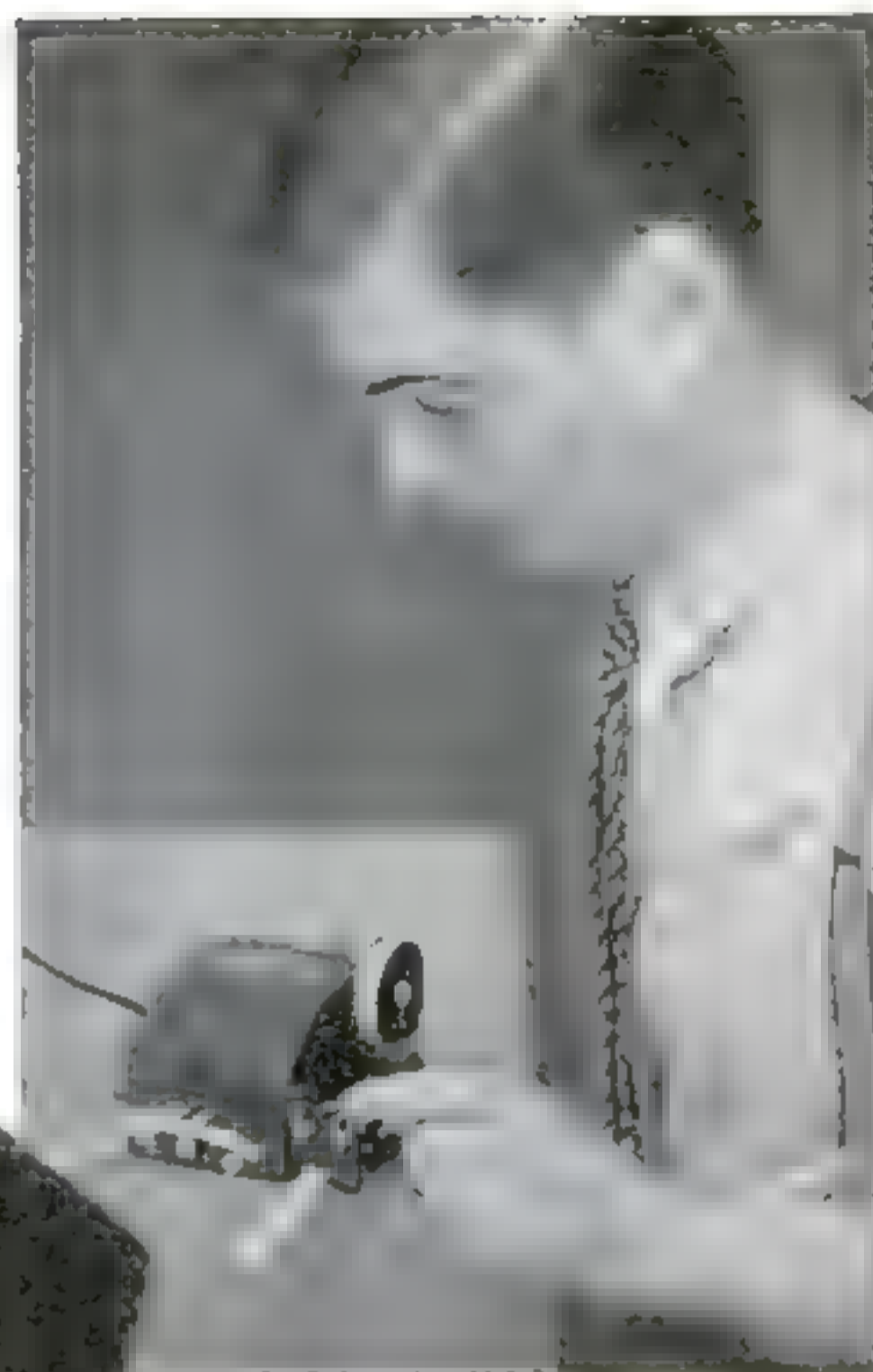
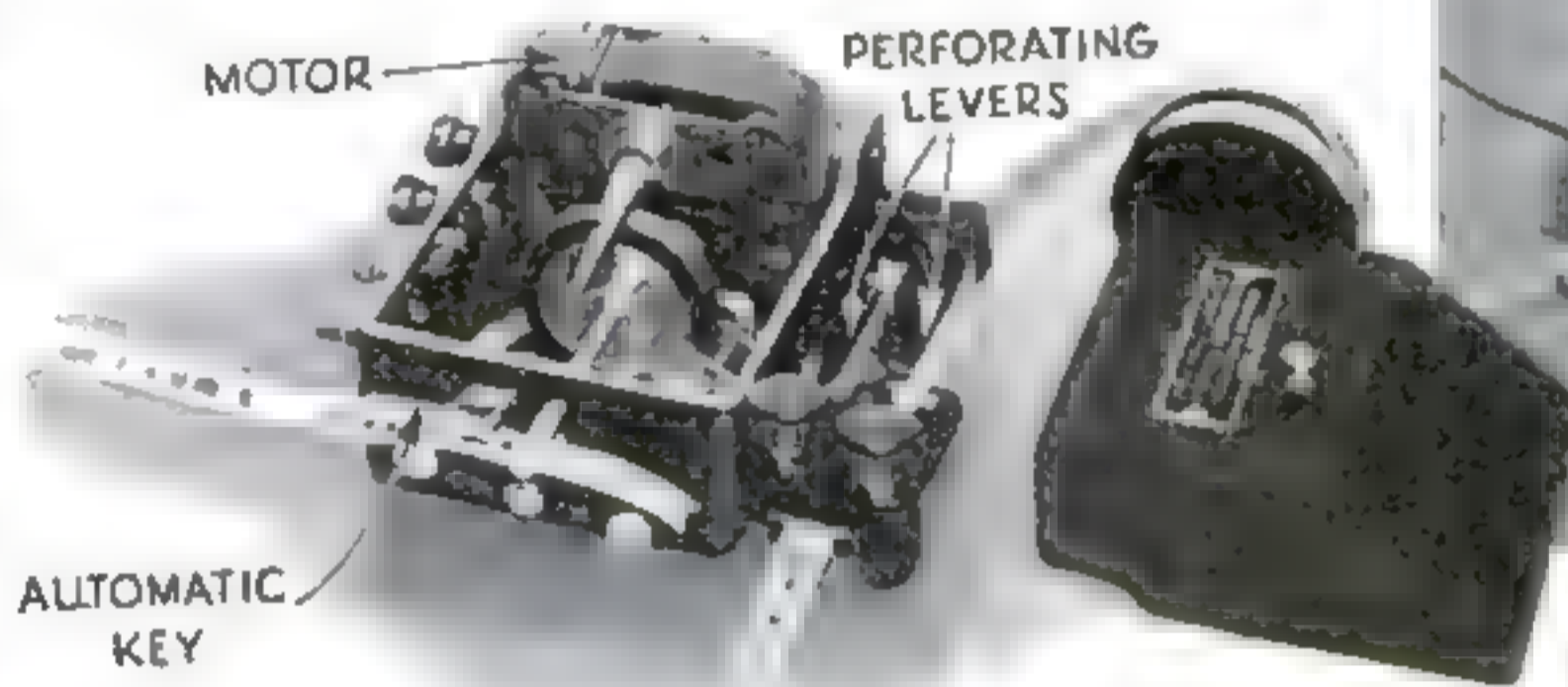


FIVE NEW IDEAS OF INTEREST TO Radio Builders

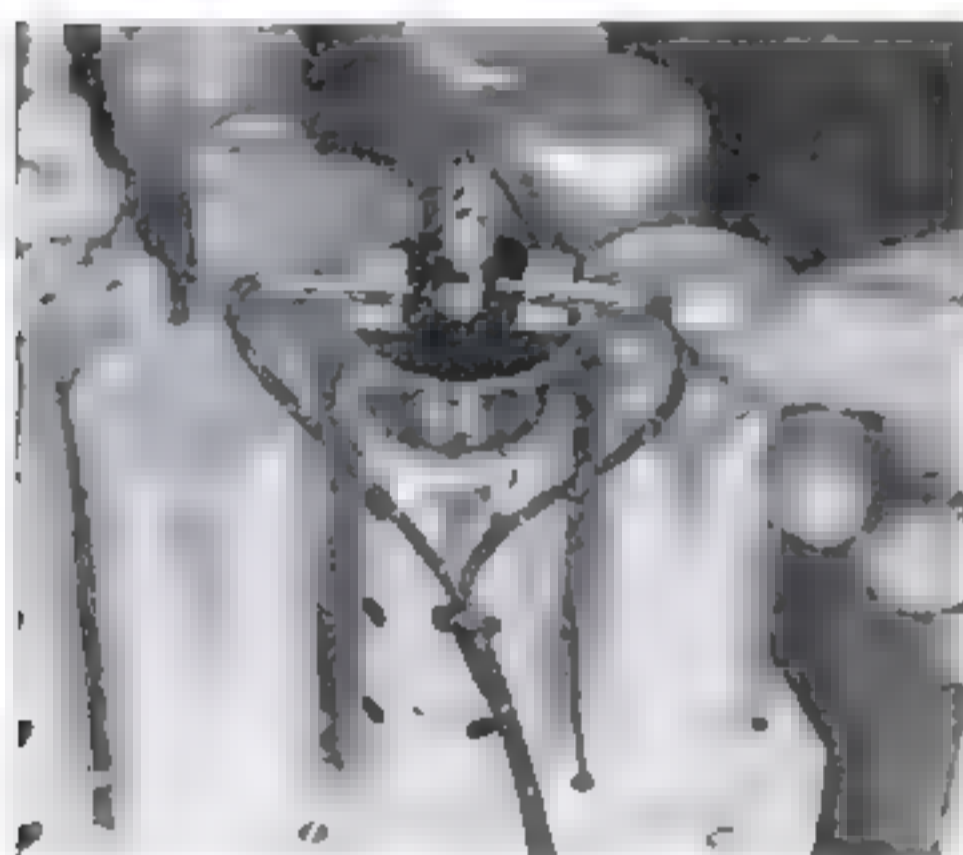
"Robot Key" Sends from Perforated Tape

A "ROBOT KEY" for amateur radio operators and students uses a perforated paper tape three eighths of an inch wide, driven by a small induction motor through a pair of contact arms which in turn "key" the transmitter or code-practice outfit. The tape is punched by hand on the side of the machine, by means of two little finger-actuated levers. Long tapes can be prepared for code-practice and instruction, or short loops containing the call letters of the station and the general call "CQ" can be

kept running through continuously. The black, crackle-finished aluminum case of the instrument is only five inches square and three inches high.



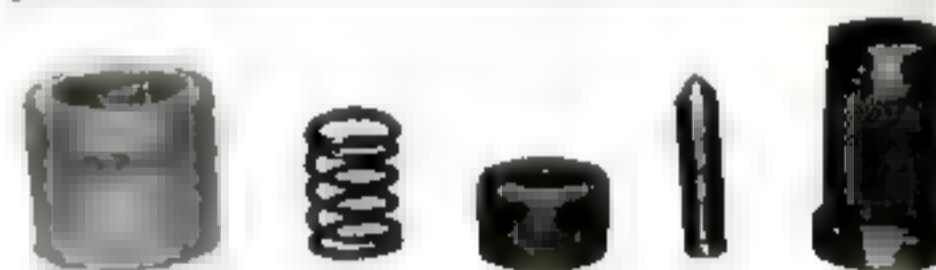
Above, punching perforations in the tape with levers on side of machine. At left, the device with cover removed and tape in sending position



The adapter in place with pick-up tips attached

Grid-Cap Adapter for Phonograph Pick-Up

CONNECTING a phonograph pick-up into a radio receiver using screen-grid tubes is made easy by a new grid-cap adapter, which can be employed on either the detector or the first audio-amplifier tube. Convenient clip-type binding posts are provided for the pick-up tips. The tube does not have to be removed from its socket, and the change from radio to phonograph can be made in only a few seconds. There are two models of this adapter available. One is for the common glass tubes, and glass-metal tubes; the other is for radios equipped with all-metal tubes.

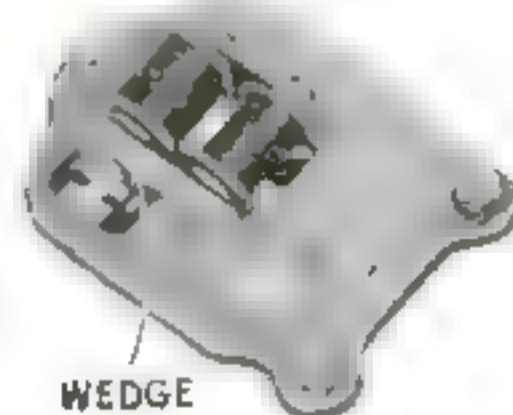


Self-Aligning Punch Makes Neat Holes

AMATEURS and experimenters who have attempted to drill socket holes with ordinary tools will appreciate the speed and convenience of a newly designed self-aligning punch, which makes clean, round holes in five seconds. No drilling is necessary; the center of the desired hole is merely pin-punched with a short, pointed rod, the chassis placed between the two halves of the tool, and the top of the punch struck with a heavy hammer. A floating, spring-supported inner piece automatically centers the punch and die.

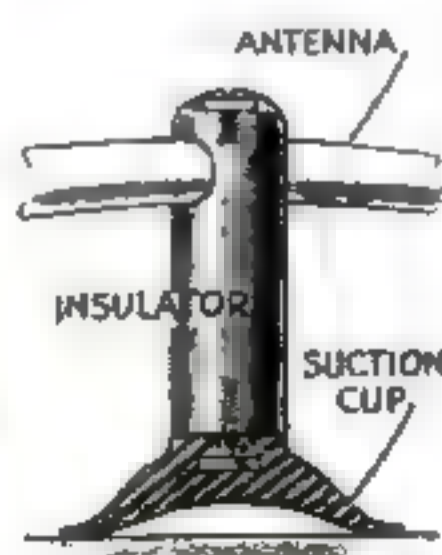
Buzzer for Code Work

By STIFFENING the vibrating armature with a small wedge cut from a match stick, you can convert an ordinary house buzzer to give a pleasant high-frequency tone, for modulation or code-practice purposes. To keep the wedge from falling out, drop a small bead of sealing wax on it. The tone can be varied by bending the fixed contact point.



Quarter-inch chromium-plated copper tubing, supported by suction-cup insulators, forms an outside antenna for a car with an all-steel body

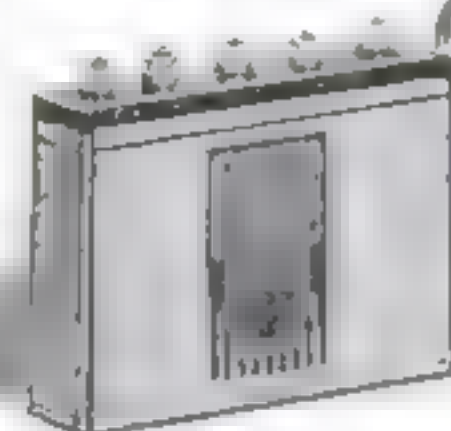
in diameter, bent by hand to conform to the shape of the car, and supported three inches above the top by means of insulators mounted on easily applied rubber suction cups. It is necessary to drill only one hole, near the windshield, for the lead-in wire. This antenna can be installed in less than half an hour. The shielding effect of the car's metal top makes it less susceptible to ignition noises than inside aerials.



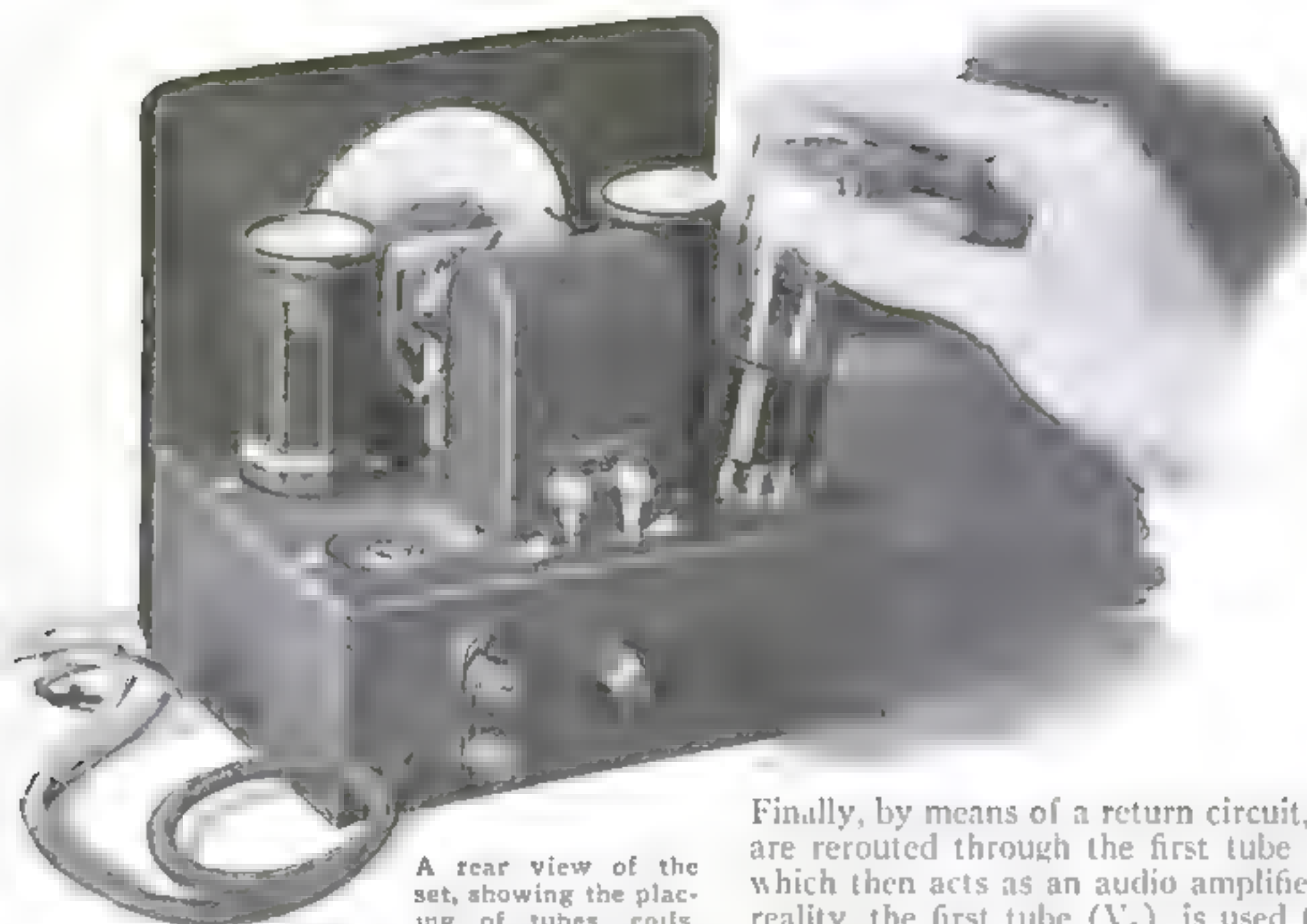
By
ARTHUR
MILLER



The completed set and its "B"-less battery supply. The circuit operates on an eleven-volt plate current



★ THREE SMALL BATTERIES POWER THIS *Beginner's All-Wave Set*



A rear view of the set, showing the placing of tubes, coils, and variable condenser

COMBINING novelty, low cost, and ease of construction, the battery-operated receiver illustrated is an ideal unit for the radio novice who has had little experience in set building. Used with a good outside antenna, the two-tube circuit will give excellent results on all wave bands from sixty five to 565 meters.

Two novel features incorporated in the hook-up make the receiver particularly inexpensive to build and operate. By means of a special "reflex" circuit, two tubes are made to do the work of three, while through the use of an ingenious grid hook-up, the tubes are made to give maximum volume with a "B" voltage of approximately eleven volts instead of the usual ninety or 180.

As indicated in the diagram and photographs, two type '49 tubes are used. Tracing the signals from the antenna through the circuit, they are fed first to the tube V_1 , which serves as a radio-frequency amplifier, and through the second tube (V_2), which acts as a tuned regenerative detector.

Finally, by means of a return circuit, they are rerouted through the first tube (V_1), which then acts as an audio amplifier. In reality, the first tube (V_1), is used twice, the second tube (V_2) once.

Because of the novel grid hook-up, which is similar to that used in a recently described receiver (P. S. M., July '36, p. 52), three small, inexpensive batteries—two dry cells, and one $7\frac{1}{2}$ -volt "C" battery—provide the necessary current supply. Connected in series, the three units provide a total of about eleven volts for the plate circuit, while the two dry cells and rheostat provide the two volts required for the parallel-connected tube filaments.

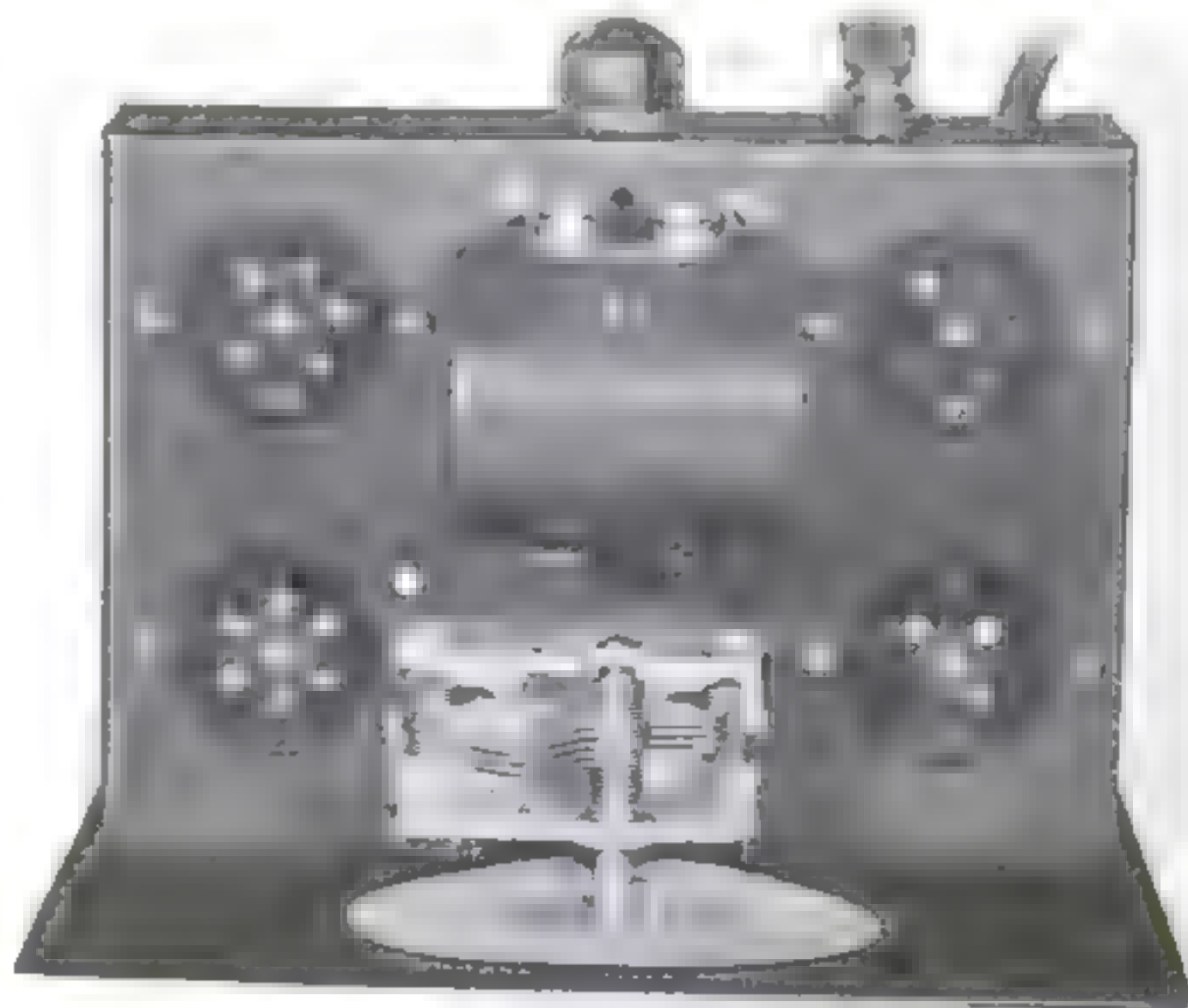
Because of this compact power supply, the circuit is particularly well suited to portable use. If extreme portability is desired, a midget storage battery of the type recently described (P. S. M., June '36, p. 53) can be used. In this case, the entire

battery unit could be carried in a pocket.

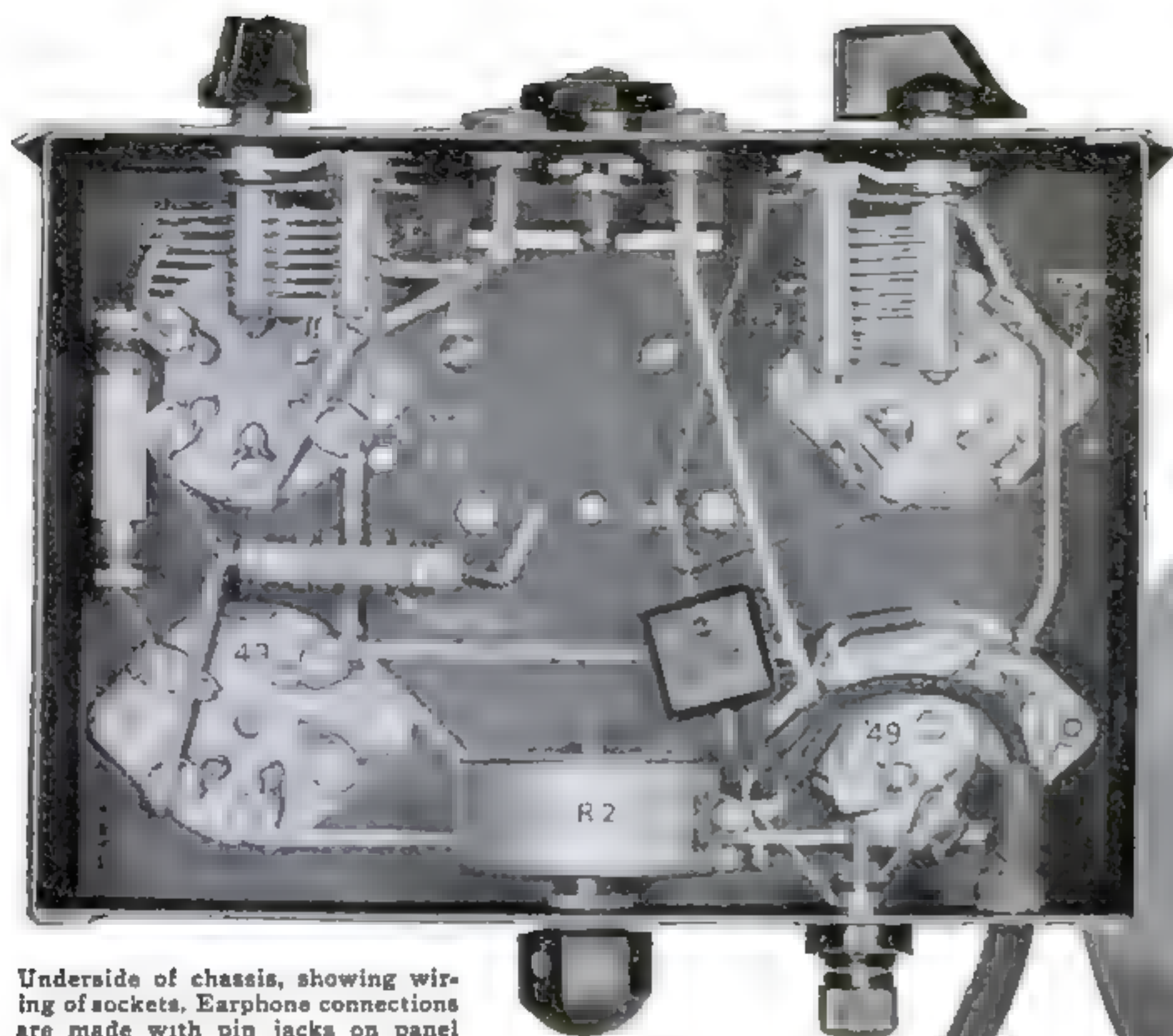
Since the dimensions of the metal chassis and panel are relatively unimportant, suitable units can be purchased ready-made at most radio-parts supply houses. They should be drilled to take the four sockets, the condenser and resistance-control shafts, the phone-tip jacks, and the two binding-post terminals. Although the chassis and panel shown have a decorative black-crackle finish, this can be omitted, if cost is an important consideration.

In assembling the parts, particular attention should be paid to the wiring of the two plug-in-coil sockets. In the diagram, the terminals of the various windings have been lettered to correspond with the conventional arrangement on four-prong and six-prong sockets. Follow them carefully, and check each connection several times to avoid error.

In studying the wiring of the plug-in coil L_2 , you will note that the primary and tickler windings are reversed. On the particular commercial coils used, it was found that the primary was too close to the secondary to give good results with this cir-



The socket layout is apparent in this view of the receiver from above. The symmetrical arrangement of parts makes wiring easy



Underside of chassis, showing wiring of sockets. Earphone connections are made with pin jacks on panel

cuit. By using the regular tickler as the primary and the regular primary as the tickler, this difficulty was overcome. Since ready-made coils vary somewhat in construction, it will be best to experiment with the connections to the tickler and primary windings. Try first one arrangement and then the other, retaining the hook-up that gives you the best volume and selectivity. By checking the prong wiring on each of the coils, you can quickly determine which prongs serve as connections to the various windings.

It is equally important to have the grids to the two tubes wired correctly. In the first tube (V_1), the control grid is employed as the screen grid, and the screen grid is used as the control grid. The wiring to the second tube (V_2) is standard.

Of the three variable condensers used, two (C_1 and C_2) are employed for tuning. The third (C_3), provides regeneration control. In use, C_1 is the vernier control, since it tunes more broadly than C_2 . If through some difference in the arrangement of parts or some slight discrepancy in the parts, you find that C_1 fails to cover the entire range of C_2 , increase the value of C_1 to .00035 mfd., and remove several turns from the secondary windings of the four-prong plug-in coils (L_1).

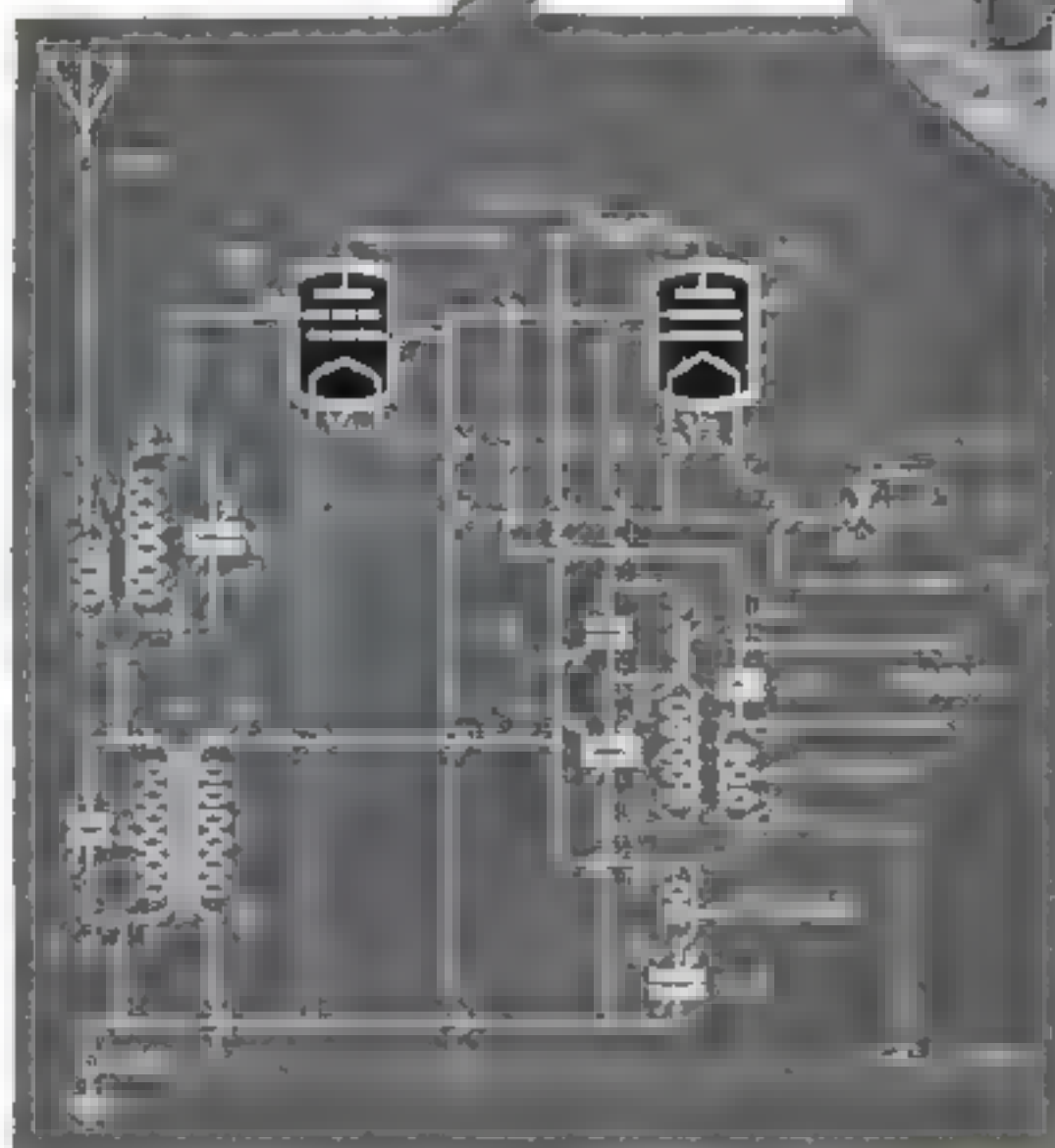
For best results, care should be exercised in selecting the audio transformer (T_1). It should have a one-to-five ratio and be of the fully shielded type. The specifications for the fixed condensers C_4 and C_5 likewise are critical and should not be varied more than fifty percent.

In tests with the receiver, the greatest volume and selectivity were obtained when the set was used with a good outside antenna about seventy-five feet in length. If for some reason or other, a shorter antenna must be used, greater volume will be obtained if the lead-in wire is connected directly to the grid of the first tube through a .0001-mfd., semi-variable trim-

No Matter How Green You Are At Handling a Soldering Iron And Pliers, This Set Will Be An Easy One for You To Wire



Simplified wiring makes this circuit ideal for beginners inexperienced in soldering



Symbols on the circuit diagram refer to parts named and described in the list of materials given below

LIST OF MATERIALS

- C_1 , C_2 , and C_3 —Variable condensers, .00014 mfd.
- C_4 —Fixed mica condenser, .001 mfd.
- C_5 —Fixed mica condenser, .0005 mfd
- C_6 —Fixed mica condenser, .00015 mfd.
- R_1 —Grid leak, 3 meg.
- R_2 —Filament rheostat, 15 ohm.
- T_1 —Audio transformer, 1/5 ratio.
- L_1 —Four-prong plug-in coils.
- L_2 —Six-prong plug-in coils.
- RFC—Radio-frequency choke, 2.1 mh.
- Miscellaneous—Two five-prong sockets, one four-prong socket, one six-prong socket, four knobs, phone-tip jacks, binding posts, chassis, panel, two type '49 tubes, tuning dial, batteries, wire, solder lugs, etc.

mer condenser, and approximately one third of the turns are removed from the secondary windings of the plug-in coils L_1 . The exact number of turns can be determined only by experiment since much will depend upon existing conditions.

For a ground, use a water pipe, selecting one that will require the shortest possible lead from the set. In making the connection to the pipe, an inexpensive clamp sold especially for the purpose will insure good contact and be easy to install.

As in all short-wave receivers of this type, the plug-in coils are one of the most important group of parts in the circuit. To avoid trouble, use high-grade units, making sure that they are designed for use with .00014 mfd. tuning condensers. If, when you first wire the hook-up, the set fails to operate, check the connections to the coil sockets. Reversed connections to the tickler winding may be causing the trouble. This can be remedied easily, however, simply by switching the wires leading to the tickler-coil prongs at the socket.

Particular attention also should be paid to any connections made to the receiver chassis. For best results, all common-return connections should be made to one soldering lug bolted to the chassis.

If carefully constructed, the receiver will give surprising volume and selectivity on the eighty and 160-meter amateur bands and the police and aircraft bands as well as the broadcast band. In average use, the batteries will last from three weeks to a month and a half before they will have to be replaced.

By MARTIN BUNN

Gus stood behind the auto and a little to one side. "All right," he called. "I'm a car about to pass you. Can you see me?"



Look Where You're Driving

"AND just as I was about to give her the gas and go after that son-of-a-gun, I spotted the motor-cycle cop behind me," young Braxton was saying, when a car drove up to the gas pump.

Gus Wilson, half owner of the Model Garage and mechanic of the establishment, who had been listening to Braxton's yarn, stepped over to the pump as the driver of the car thrust out two hands with eight fingers extended. Gus pumped in the eight gallons, took a bill, and handed back the change. The car rolled off, with a smiling wave of the hand from the driver.

Meanwhile, Braxton had been eyeing the car. As it pulled away he turned to Gus.

"What's the idea of the mirrors that fellow has on his car?" he asked. "Did you notice them all? There was a regular mirror inside above the windshield, another one mounted on the left fender, and still another fitted on a long bracket on the right front door so he could look in it through the door glass. He must be afraid a cop will sneak up on him or something!"

"That's all you young fellows think about," growled Gus. "Driving like maniacs and watching for cops! That chap needs those mirrors. He's assistant superintendent at the Vocational School down the road a piece. He's in charge of the deaf-and-dumb classes, and is a deaf-mute himself. He has to make his eyes do what other people think they can do with their ears. If you ever pull up behind him and

you want to pass, don't bother to blow your horn. He couldn't hear it. But he'll spot you right away in his mirrors and pull over anyhow. He always does that when a car comes up from behind.

"I'd feel a lot safer and surer of staying out of the cemetery riding with him, than I would with a lot of you speed demons!" Gus finished, with a grin.

"How do you get that way?" Braxton snapped. "I can see what's in back of me without any extra mirrors."

"You can, eh?" grunted Gus. "Climb in your bus a minute." He stepped over to the position, behind and slightly to the left, that would be occupied by a car that was just about to pass Braxton's.

"All right," he called. "I'm a car behind you. Can you see me?"

Braxton moved his head, first to one side and then to the other, in an effort to see Gus, but the left rear portion of the body hid the garageman completely from the inside-mirror view.

Finally, he poked his head out of the window and looked back at Gus. "You win," he admitted sheepishly. "I couldn't see much of a car in just that position."

"Now we'll try again," said Gus, and he stepped over to the corresponding position at the right rear of the car.

Again, Braxton had to admit a partial blind spot.

"Now you can see where those extra mirrors would come in handy," Gus pointed out. "And the worst of it is, the blind spots come right where they are most likely to cause accidents. That is, when a car

is swinging out to pass you on either the right or left. Or if you happen to be parked at the curb, and you have to back up in order to clear the car parked ahead of you, you can't see anybody about to step off the curb right under your wheels.

"Of course," Gus went on, "the size of the blind spot varies with different body constructions, rear and side window sizes, and so on, but it is there as long as the whole body isn't made of glass. A wide, curved mirror helps some, once you get used to the curved effect."

"It's funny the makers don't go into the mirror question more carefully," Braxton observed.

"Well," said Gus, "as long as the public is willing to rubberneck around to see what's behind, and outside mirrors spoil the sleek looks of a car, you can bet the makers won't fit them. So, if you want real rear vision, you've either got to keep on kinking your neck or have special mirrors fitted."

"They'd be mighty useful to spot cops sneaking up behind you," Braxton commented with a grin. "Guess I'll look into it."

"Humph!" Gus snorted. "Always thinking of speeding and cops! Still, a mirror on the left of your car may do something more important than spot a cop for you. It may save you from shooting out from a curb right into a car that's passed out of range of your regular mirror."

"Almost got caught that way yesterday," Braxton admitted.

"And if you (*Continued on page 129*)

THE HOME WORKSHOP

PRIZE-WINNING

Buffet Set

Step-by-step directions for turning a beautiful inlaid walnut bowl and a pair of candleholders to match

By ROBERT B. DYER

TO CREATE something beautiful, something that will find a welcome place in the home because of its charm and usefulness, is a desire of every true craftsman. The extra effort and infinite care required to produce really fine work are only too gladly expended if the article promises to merit pride. The fruit bowl and candleholders illustrated on this and the following page are exquisite pieces, and to reproduce them is a challenge to the initiative of anyone who enjoys lathe work.

This set has won several awards, including second prize in the wood-turning division of the first National Handicraft Exhibition and Contest of the National Homeworkshop Guild at Chicago in 1935. Its beauty lies in graceful design, wise choice of materials, careful workmanship, and fine finish. Its construction is not extremely complicated, but requires a little thought and care.

The bulk of the material used is black walnut. The wood should be carefully selected because a good grain will contribute much to the beauty of the completed pieces. The light wood used is white holly. The bird design in the center of the bowl is cut from vermilion wood.

The bowl. Select a piece of white holly 9 in. square and $\frac{1}{8}$ in. thick, and a piece of $\frac{3}{16}$ -in. vermilion, 9 in. square. Glue them together with a piece of paper between to facilitate separation later.

Draw the birds and limb full size on plain paper, and glue the design to the center of the white holly. To start the scroll



The inlaid effect of these graceful pieces is obtained by gluing together walnut and white holly in such a way that the lines and spots will appear in the right places when the turning is done

saw, drill a hole with about a No. 72 drill at the edge of the tree limb at the extreme left of the design. It is best to use a very fine jeweler's blade in the saw.

It is important that the vermilion birds and limb fit snugly into the white holly background. This end can be accomplished by adjusting the saw table at about a 2-deg. angle so that when the cut-out has been made, the birds and limb will wedge into the background piece (Fig. 1). When the saw is being adjusted, it is wise to make a trial cut on a scrap piece of material of thickness similar to the glued square.

After the design has been scrolled out, separate the vermilion from the holly with a sharp knife. Now fit the vermilion birds and limb into the cut-out in the white holly. Being of thicker wood, the vermilion will, of course, require sanding on each side until it becomes flush with the holly.

Next is the formation of the bottom of the bowl. A piece of walnut $\frac{3}{4}$ in. thick and 9 in. square is needed (Fig. 2). Place the walnut on the workbench and glue the white holly to it with the inlaid bird design in place, face up. Be sure the borders of the holly are even all around.

On top of the holly, glue a 1-in. thick, 9-in. square piece of walnut. To this walnut square, glue a $\frac{1}{8}$ -in. thick, 9-in. square of white holly, and last, glue a $\frac{3}{4}$ -in. thick, 9-in. square piece of walnut. This may sound like an odd conglomeration, but when the turning is done, it will look different (Fig. 2).

'HANDCRAFT' ON THE LATHE

Most universally used of all home workshop machines is the wood-turning lathe. And no wonder, because turning is not a mechanical or monotonous machine process; it is really a fine type of handcraft. Your own hands hold the chisel or gouge, and you guide the cut by eye. The work is always fascinating, but it becomes doubly so when you are making so beautiful a project as the buffet set described in the accompanying article.

Vermilion wood birds inlaid in holly decorate the inside of the bowl. The inlaying is done before the bowl is turned



When the glue has dried, remove the clamps, center the synthetic block on a 3-in. faceplate, and mount the work in the lathe. Use a $\frac{3}{4}$ -in. gouge to rough off the corners, and turn down to a cylinder, 9-in. in diameter. Converting the block into a cylinder reduces the vibration and makes easier the somewhat precarious work of cutting out the interior of the bowl.

The course to be followed in routing the inside of the bowl is indicated in the drawings. As a precaution against chipping the rim, make a light cut with the point of a skew chisel about $\frac{1}{4}$ in. inside the rim on the face of the cylinder. This cut also determines the outside diameter of the bowl.

With a round-nose chisel, hollow out the inside of the bowl. Keep turning until the bird design appears, and then proceed carefully until the white holly background reaches a diameter of about 4 in.

This done, turn down the outside of the bowl to the shape shown. Leave the walls about $\frac{1}{8}$ in. thick, shaping gradually down until the lathe faceplate is reached. Smooth the bowl, inside and out, with very fine sandpaper and triple-O steel wool. To bring out the whiteness of the holly, sand the holly only, being careful not to touch the walnut, as the brown dust would discolor the holly.

To prevent warping, immediately finish inside and out with shellac and oil (French polish). Of course, this should be done while the bowl is revolving in the lathe. Remove the bowl and faceplate from the lathe and take the faceplate off the bowl.

Before the bottom of the bowl, left flat by the presence of the faceplate, can be shaped, it will be necessary to construct a makeshift chuck to hold the rim of the bowl. For the chuck, select a piece of 1-in. pine and turn it to a disk, 10 in. in diameter. Rout out the middle section of the disk to a depth of about $\frac{1}{2}$ in. until the rim of the bowl fits snugly into the chuck. It may be necessary to tap the bowl lightly to fit it into the chuck. Do not worry about



Turning the pedestal of the bowl. The drawings and a layout for the birds are given at right

the bowl's coming off the chuck, once it is in the lathe, because centrifugal force will hold it in place.

Complete turning the bottom of the bowl with a round-nose chisel, and drill a $\frac{1}{2}$ -in. hole to a depth of $\frac{1}{2}$ in., using a $\frac{1}{4}$ -in. carpenter's chisel. Finish the bottom of the bowl with shellac and oil. Do not remove the bowl from the improvised chuck, but take the chuck, with faceplate attached, from the lathe.

The pedestal. For the pedestal (Fig. 3), use walnut, $1\frac{1}{4}$ by $1\frac{1}{4}$ by 6 in. This piece must be absolutely square and must be precisely centered when placed in the lathe. If the piece is not exactly square, or properly centered, the white holly spots appearing in the pedestal design will not be of uniform size when the turning is complete.

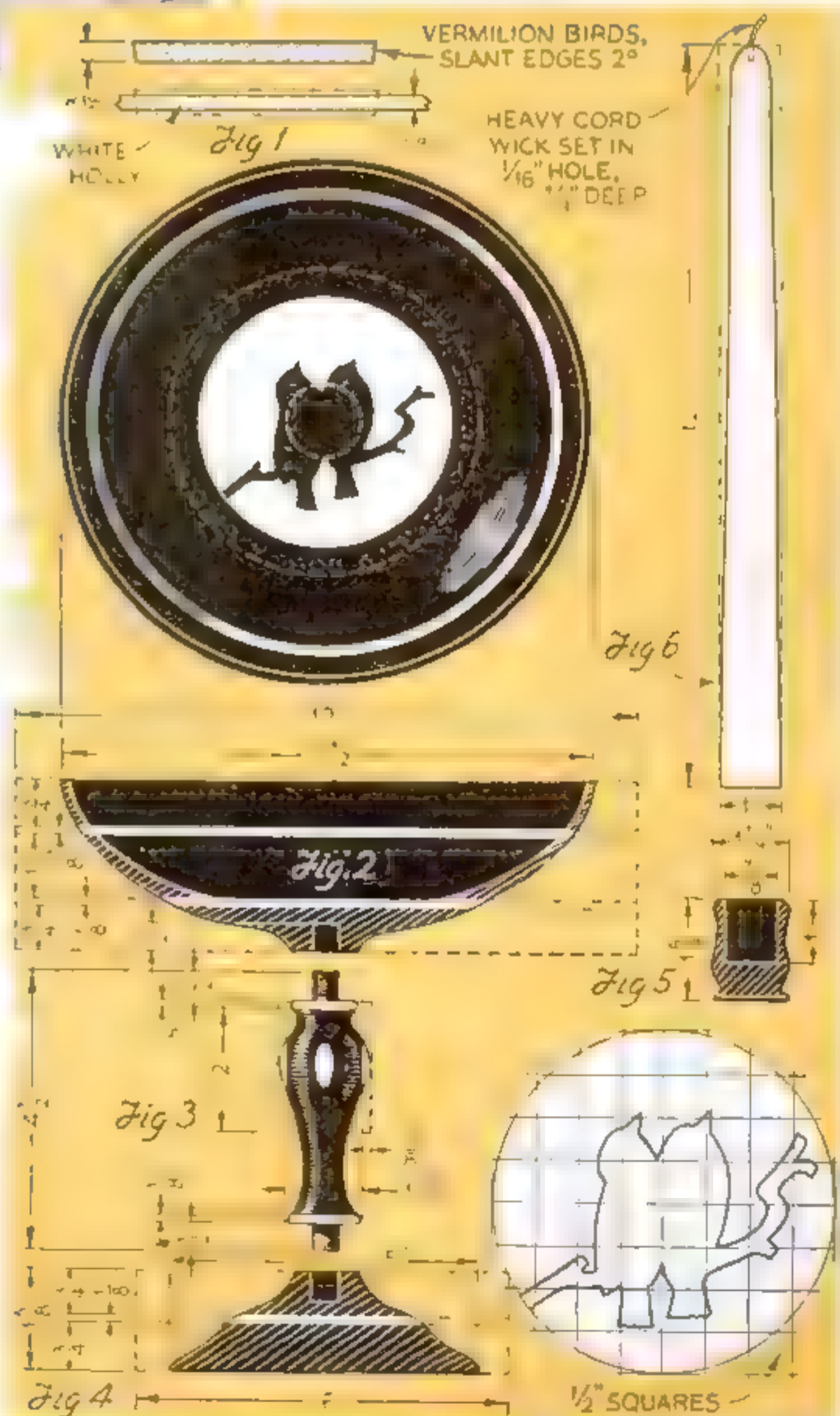
After the walnut has

been selected, cut four pieces of $\frac{1}{8}$ -in. white holly to $1\frac{1}{4}$ by 2-in. dimensions. Glue one piece of holly to each side of the walnut at the point where the spots are to appear, as indicated in Fig. 3.

Rough the pedestal to shape with a gouge, and smooth it with a skew chisel. Of course, most of the white holly will be cut away, thus forming the spots. If, because of faulty centering, one of the spots appears larger than the others, it may be reduced by using fine sandpaper on that particular spot while the pedestal remains stationary in the lathe.

The rings at each end of the pedestal are made from white holly $\frac{1}{8}$ in. thick. Cut the holly to a square, $1\frac{1}{4}$ by $1\frac{1}{4}$ in., and drill a $\frac{1}{2}$ -in. hole in the center of each piece so that the squares can be slipped over the dowels. It might be well to cut the corners from the squares so that when the rings are turned later on, the danger of chipping will be reduced. Lay the pedestal and squares aside until the base is turned.

The base. To build the base, use two pieces of walnut, $\frac{3}{4}$ in. thick by 6 in. square, and a piece of white holly, $\frac{1}{8}$ by 6 in. square. Glue these three pieces together with the holly sandwiched between the walnut. Turn to shape as shown in Fig. 4 by using a round-nose chisel. Drill a $\frac{1}{2}$ -in. hole in the (Continued on page 113)



Enameling *the Modern Way*

New Materials and Methods

Enable You to Rival the Flawless
Work of a Professional Brush Hand

By RALPH G. WARING

ENAMELED woodwork or interior trim was considered a beautiful but expensive luxury only a few years ago. The enamel then in use was the so-called "oil type," expensive and slow in drying. It could be applied only by the most expert of brush hands because of the great difficulty in preventing sags or drips. Today our modern four-hour or quick-drying enamels, whether in flat, egg-shell, or gloss forms, can be applied successfully by anyone who will take the time to study the accompanying photographs and follow the suggestions I am going to give.

These new materials have made their appeal not only to men who take pride in keeping their homes shipshape, but also to women, who find in them the answer to their never-ceasing demand for an easy brushing, nonsagging, quick-drying, cover-in-one-coat type of enamel for use in touching up furniture.

For the majority of enamel work, two types of brushes are desirable. Furniture, with its narrow and often turned surfaces, requires a semisoft brush of the 1½ to 2-in. fitch, bear, or oxbair types. The latter is perhaps the best for the home worker who has learned to buy a few first-quality brushes and take proper care of them. For larger and broader surfaces such as interior trim and doors, the standard form of black China bristle known as the XXX (triple-X) varnish flowing type will do a fine piece of work. Brushes 1, 2, and 3 in. wide are suitable for this.

Before the brushes can be used in enamel, they should be carefully dry-cleaned by flicking the bristles across the fingers, then washed in turpentine, and last worked in varnish to fill the bristles at least a day or two before use, if possible. Before dipping them in the enamel, use an ordinary table knife to scrape the varnish from the brush without getting the bristles out of shape. Do not wash the brush in turpentine, or the traces remaining in the heel of the brush will cause the enamel to bubble or even foam while being applied.

Previous articles (P. S. M., Dec. '36, p. 76, and Jan. '37, p. 72) have dealt with the preparation of the surface, including washing, sanding, and putty work, all of which are exceedingly important. To keep the surface clean just ahead of the brush is one of the really vital problems of doing

good enamel work. One of the most practical means is to use a so-called "tack rag." An old handkerchief is good because of its hemmed edges. Dip the cloth in water, wring quite dry, and then sprinkle lightly with varnish. Refold and rewring so that the traces of varnish permeate the cloth. Keep it rolled up in a piece of oil-cloth or waxed paper when not in actual use to prevent drying out. Should this occur, sprinkle with water and wring out again.

First, carefully dust off the work with a regular dusting brush; then wipe off with the tack rag to pick up any traces of lint
(Continued on page 116)



1 To commence an enameling job such as this, run the panel line with a narrow brush. Do not cover the rails (cross members), stiles (uprights), or the panels themselves



2 A wider brush is next used on the panel. Apply the enamel with overlapping strokes laid on in an X-fashion



3 The panel is finally tipped off with only the bristles of the brush. Avoid any pressure and work halfway up and halfway down to center of panel



4 The cross members of the panel, door, or other work are next brushed from the ends toward the center of each one

5 Finally the stiles are cut in so the brush strokes cross the brush lines left when the rails were coated in the previous operation. Avoid any retouching once the enamel has begun to set

WHAT YOU CAN DO TO Keep Your

REPLACING OLD-STYLE LIGHTING FIXTURES

OLD-STYLE combination gas and electric lighting fixtures are still to be found in many homes. These and other obsolete fixtures should be replaced with some form of modern electric fixture that will be serviceable and pleasing to the eye as well, such as the neat one-light candle sconce illustrated. The directions given in this article can be applied to almost any kind of out-of-date fixtures.

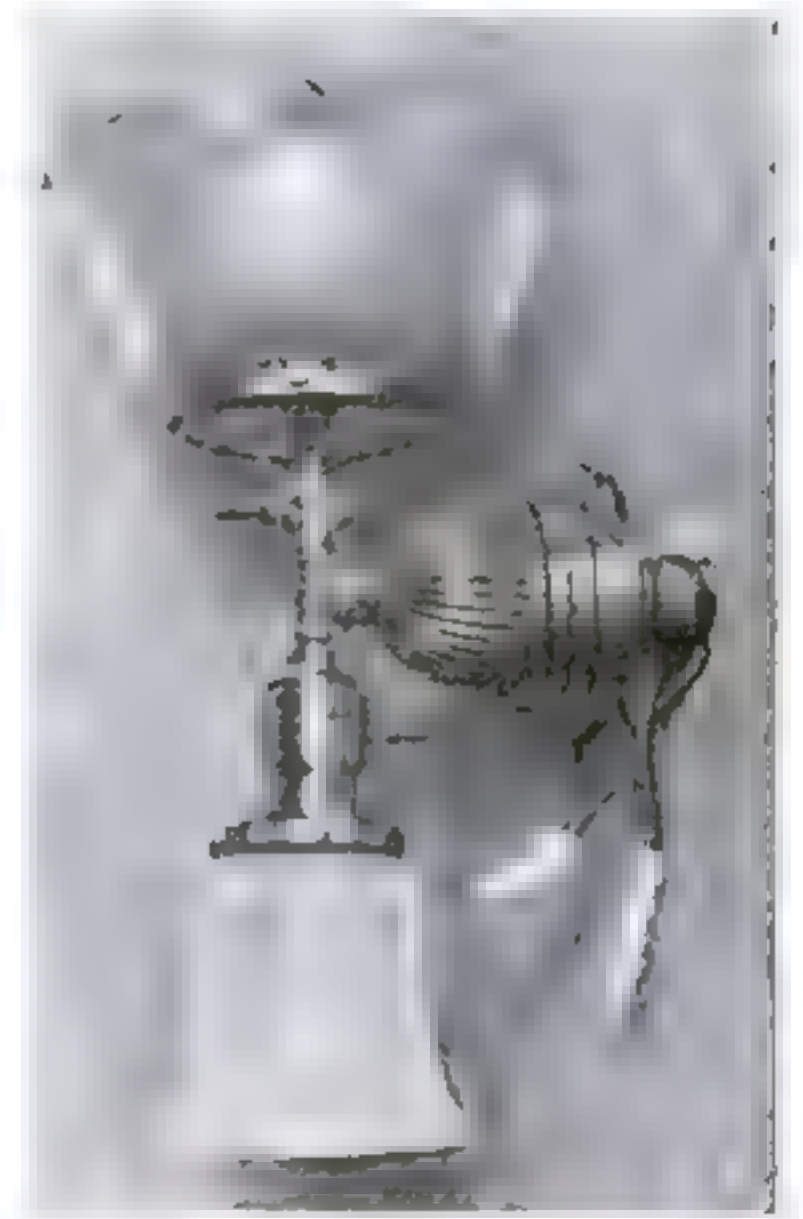
One photograph shows an old fixture before it was removed, with the canopy pushed back for inspection. It will be noted that there is no outlet box as required today at every outlet, but the wires were merely brought through the plaster and taped to the gas pipe, just back of the round insulating joint.

After the fixture has been removed, a hole is cut in the wall to receive an ordinary switch box. Locate the box in relation to the laths so that the screws will get a secure hold in the laths and not pass between them. The gas nipple is unscrewed from the elbow, and to stop the flow of gas a $\frac{3}{8}$ -in. gas plug with its threads smeared with white lead is placed in the end of an open-end wrench and passed in the hole to the elbow. The plug may be tightened in the elbow by using a heavy screw driver in the other end of the wrench for leverage.

Circular loom tubing is placed on the wires for better protection from the gas pipe and also to bush the holes in the box so the insulation of the wires will not be

Up-to-date electric fixtures like this one-light candle sconce are inexpensive, good looking, and easily installed

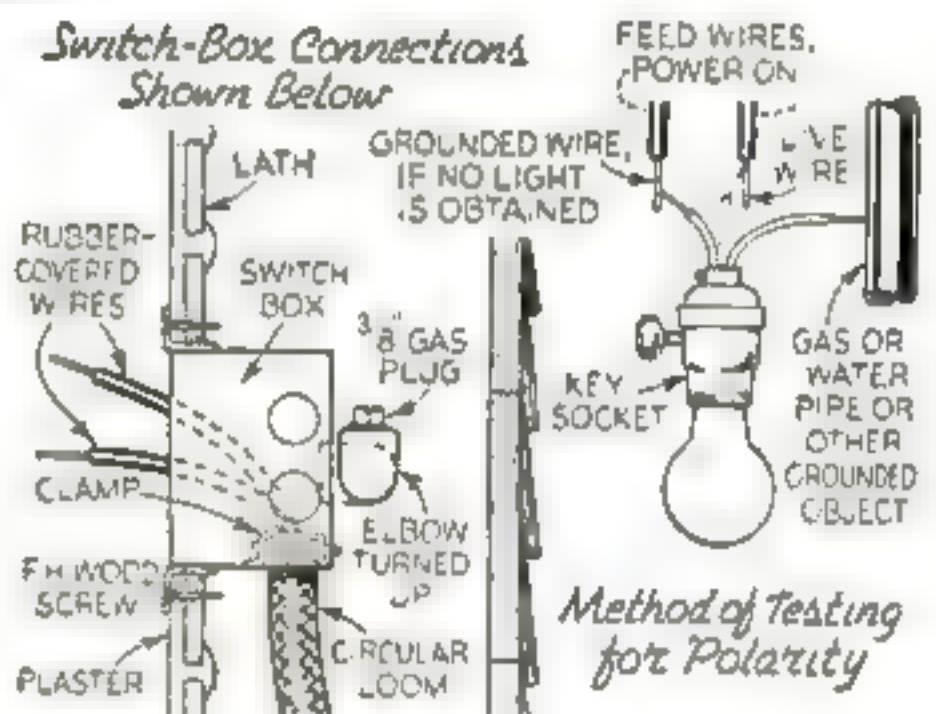
Below: A rear view of the fixture after the connections have been made and the joints soldered and taped. It is ready to be set against the wall and clamped with the knob



An obsolete combination fixture. Note that there is no outlet box



Cross section of wall showing new bracket outlet in place, and a diagram to illustrate an easy way to test polarity of an old circuit

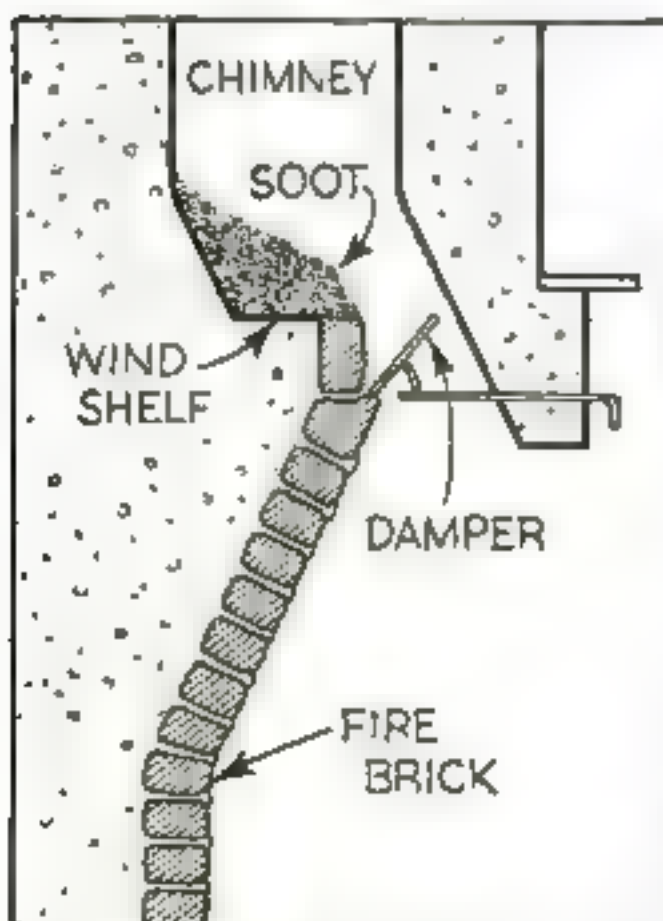


damaged. The loom should be pushed over each wire and carried back to the porcelain insulator usually nailed to the stud 6 in. or 1 ft. from the outlet, inside the partition.

It may be found that the elbow and plug project too far out in the wall opening to allow the box to go in its full distance. In case the pipe cannot easily be

pushed back out of the way, a small pipe wrench can be used to give the elbow a quarter turn, thus pointing the elbow upwards (or to the left in case the gas pipe runs vertically). If this still fails to give enough clearance, a special shallow box can be purchased that is $1\frac{1}{2}$ -in. deep instead of the regular $2\frac{1}{2}$ -in. switch box. The *(Continued on page 112)*

SIMPLE WAYS TO IMPROVE AN OLD AND SMOKY FIREPLACE



Above: Where soot collects and impairs the efficiency of the wind shelf. *Right:* Resetting loose fire bricks with ordinary furnace cement mixed with water

HAS your fireplace lately acquired the bad habit of smoking? Do the fire bricks on the sloping back wall hang out like a bag and threaten to fall at any moment? If so, the trouble is easily repaired.

The fire bricks that line the fire box are set with

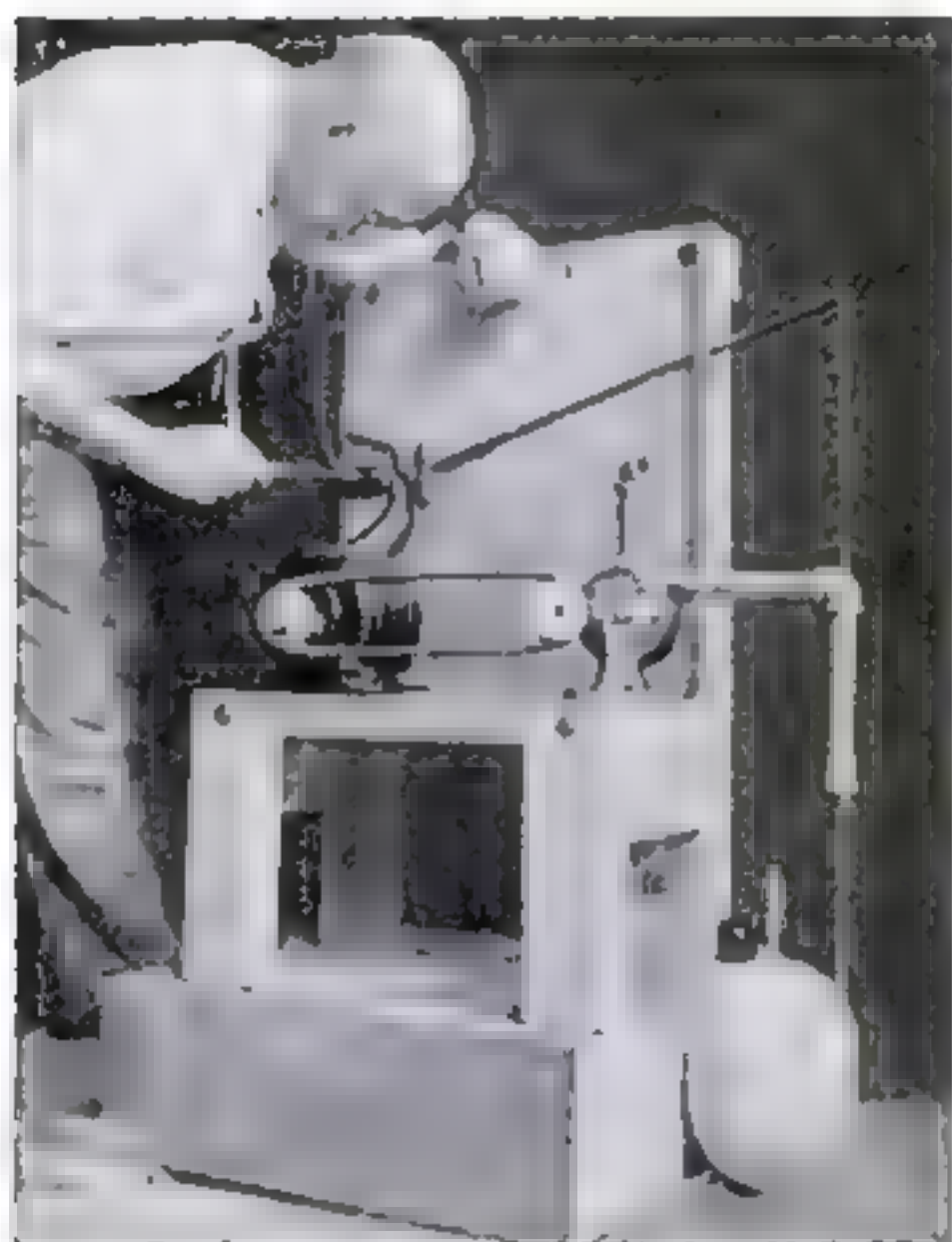


fire clay. This clay burns out, dries out, and crumbles so that the bricks get loose and slip a little. To reset them, get a can of furnace cement from the hardware store and thin it with water until it will spread easily. Pull out the loose bricks and clean them, removing all clay, soot, and dirt. With a putty knife or an old kitchen knife, spread a thin coat of the cement on the edges where they fit together. Do not get this too thick or the bricks will not all go back in place. When all have been reset, take a mallet and tap them back so they line up in a straight front. Allow the cement to dry at least partially before building a fire. This makes a better bond than the original clay because the cement burns very hard and will not crumble. While you are about it, point up any open seams or chipped corners in the remainder of the fireplace brickwork.

To cure the *(Continued on page 112)*

Home Shipshape

AUTOMATIC PUMP KEEPS BASEMENT DRY



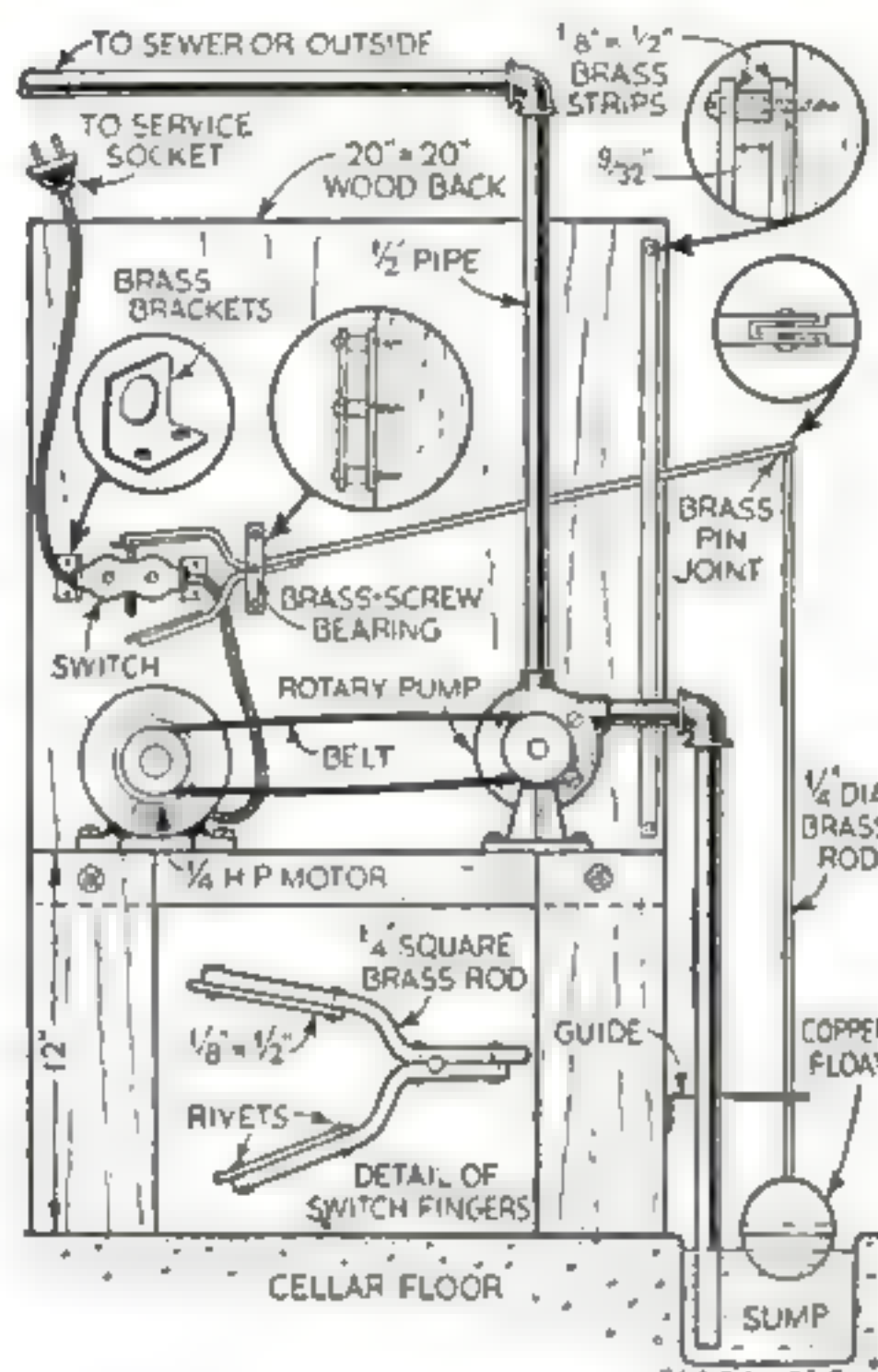
Installing the heavy-duty push-through switch, which is operated through levers by the float

HAVING a cellar that draws water during wet spells and being a home workshop addict, I designed and built an automatic electric pump to keep the basement dry. The accompanying sketches show how the system is arranged.

No elaborate tools are needed for the construction and, with the exception of the motor, pump, and brass rods, all the materials were purchased locally or were on hand. In order to prevent warping from dampness, I assembled the heavy bench and its backboard with lag screws.

To get the angles of the switch fingers correct, I drew an accurate full-size sketch of the switch on a large sheet of paper

and then marked the fingers in both the off and on positions. The drawing was used as a pattern for bending the fingers to get the proper angle of contact. No dimensions are given because they vary with the size of the switch, but to get adequate leverage, the distance from the arm bearing to the float-arm joint should be at least four times the distance from bearing to switch keys. The total cost was eighteen dollars.—C. K. HOLSINGER.

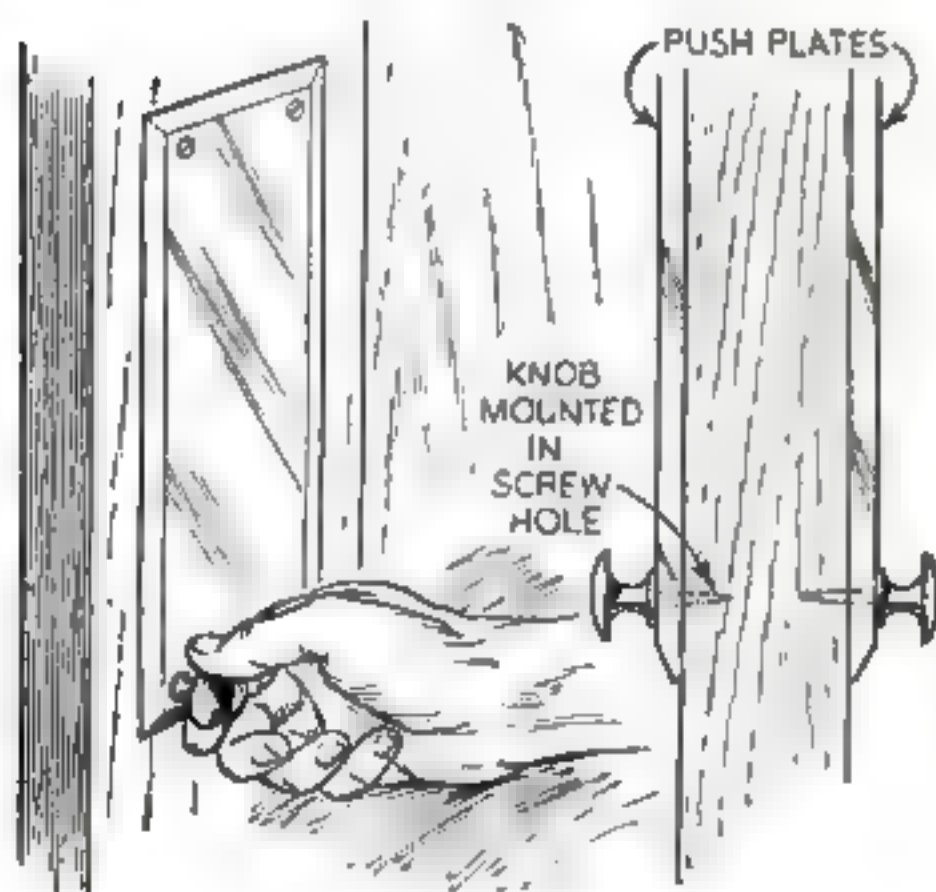


Diagram, with parts enlarged for clearness, of the outfit with its float-operated switch



LAMP PLACED UNDER BED LIGHTS FLOOR ONLY

SUFFICIENT illumination to enable one to find his way safely about a bedroom, yet so directed and subdued as not to awaken sleepers, can be provided by installing a light as shown. Only a keyless porcelain or composition socket, pear-type switch, plug, low-voltage lamp, and length of lamp cord are needed. Fasten the socket to the spring or frame under the bed. The switch can be placed anywhere desired. One end of the cord is connected to the switch, the other to the plug, and the socket is cut into one side of the cord.



SMALL PULL KNOBS HELP OPEN SWINGING DOOR

SWINGING doors, such as are used between kitchens and dining rooms, can easily be opened toward a person by screwing a small knob to each side of the door or by removing one of the wood screws holding each push plate and substituting the knob as shown above.—ARTHUR L. D. FORD.

Home Improvement Hints for FEBRUARY

HAVE you looked around your home recently to see how you could improve it? While winter storms rage outside, you have more spare time than usual to undertake needed repair jobs. Here are a few suggestions for February:

- Construct a laundry chute.
- Replace worn cords on all electric appliances.
- Install thermostatic control system.
- Brighten the basement with paint.
- Repair hearth, fireback, and dampers in fireplace.
- Build in a new bookcase, window seat, or china closet.
- Construct extra shelves in attic.
- Replace broken, loose, or missing balusters.
- Cover kitchen floor with new linoleum or rubber tile.
- Repair cracked, loose, or fallen plaster on walls and ceiling.
- Modernize old-fashioned interior trim and doors by replacing with new.



PREVENTING DUST FROM BLOWER-TYPE FURNACE

AFTER having a blower attached to the furnace for burning buckwheat coal, I was faced with the problem of how to prevent the ash dust from rising when the grate was shaken. The blower, as is usually the case, is set in an opening in the large ash-pit door where the shaker was formerly used, so the entire door had to be opened to shake the fire. I made a cardboard template of the ash-pit door and cut a piece of galvanized sheet iron to use as a shield, as shown above. This is placed in front of the opening when I use the shaker.—JAMES F. SCHINDLER.

Hand Puppets

HOW TO MAKE AND MANIPULATE THEM

By
Florence Fetherston Drake



A puppet theater can be set up in a doorway, in this case a wide one with folding doors. Mother and son are practicing a Christmas play

HAND puppets are simpler to make and easier to operate than string-controlled marionettes. They have the additional advantage of being able to present a drama on the simplest of stages or on no stage at all—a window, a door opening, or even a break in the shrubbery outdoors.

The body of this kind of puppet or guignol is really the hand of the puppeteer inclosed in a cloth bag. Arms and legs, if any, are attached to the bag. The shortness of the arms and the queer anatomy, which must be disguised by drapery, are handicaps, to be sure, but anyone who intends to take up puppetry seriously should try both types before deciding which suits him the better.

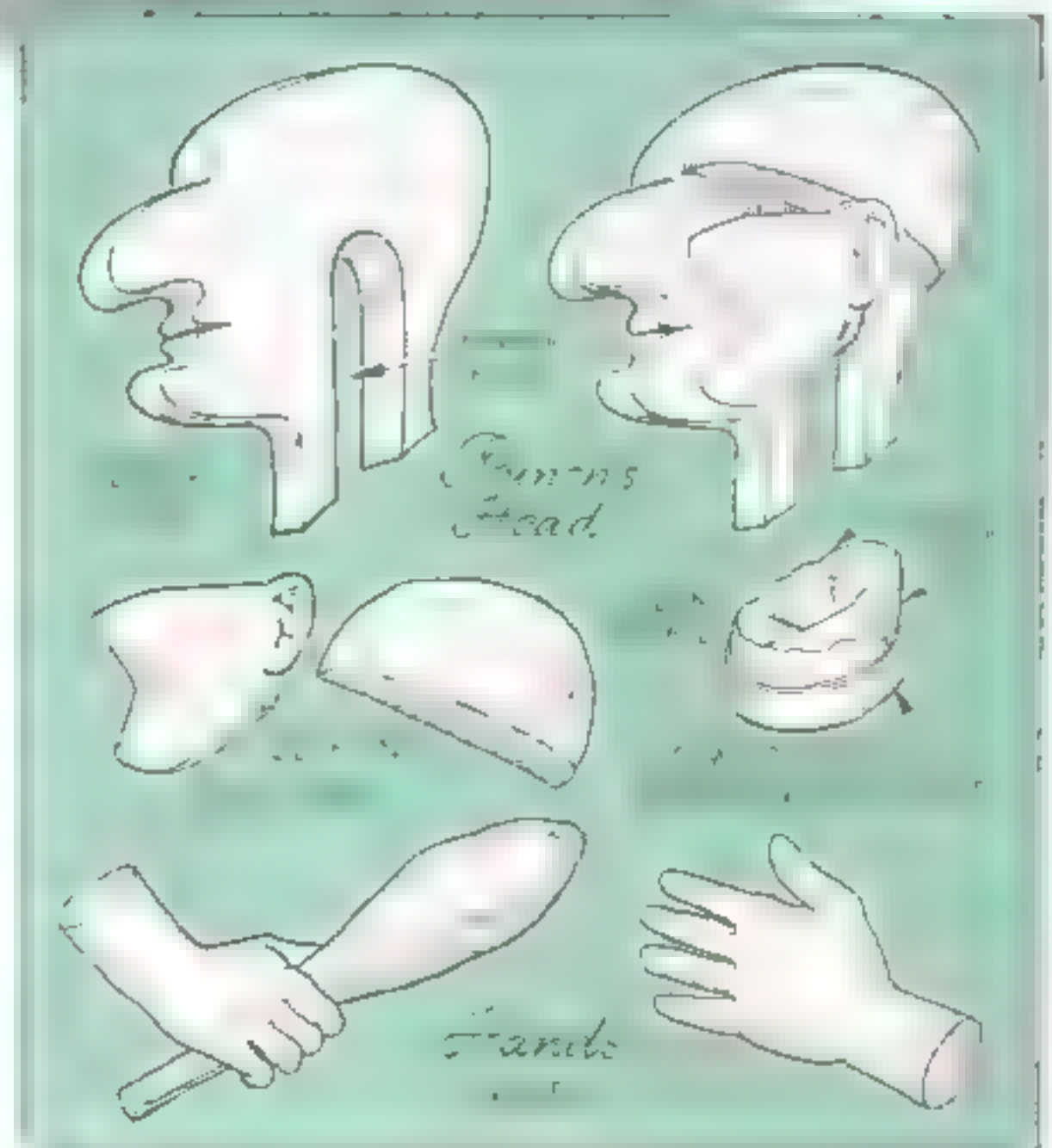
Even very young children can be taught to make hand puppets from paper pulp or rags and produce entertaining little plays. In fact, no matter how they are made, hand puppets seem to be born, as it were, with a genius for acting.

Their size, which is determined by the human hand over which they are stretched, varies but little. The usual height is 18-in.—the length of the operator's forearm and hand plus half the length of the puppet's head. The heads are generally 4-in. long, including the neck. The width of the shoulders is the space between the operator's thumb and middle finger. His wrist is the puppet's waist.

Heads for hand puppets are made in

various ways, but in all cases it is necessary to prepare rough sketches, actual size, for both profile and full face. Paper pulp may be used as described for marionettes in a previous article (P.S.M., Jan. '36, p.57). The stick which forms what is called the armature must be a trifle larger than the operator's forefinger, so that when it is removed and discarded, the head will fit on the finger easily and comfortably. In this case no extra tube is needed.

Wooden heads may be made as shown in the drawing of Mr. Punch. The center is cut from soft wood with a fret saw, and the four thicker pieces for the sides of the head and the cheeks and ears are whittled to shape, sandpapered, and then glued or nailed to the centerpiece. Depressions are filled with cotton batting or similar material soaked in paste, or with paper pulp, and finally covered with stockinet drawn tightly over the whole face. Stitches to accent the features are sewed here and there with a large needle and stout



How the parts for Punch's head are cut from wood and assembled; sketches to aid in carving his hands; and, above, a photograph of Punch, Judy, and the baby ready to perform

Head and arms move when you wriggle your fingers, and your wrist serves as a very flexible waistline

thread, and these also hold the covering.

Choose a brownish flesh-color stockinet for Mr. Punch. When rouge is rubbed on the nose and cheeks, and a few lines of black crayon are added, this will give the desired effect. The cap is made of felt and the costume of gayly colored fabrics.

The head can, of course, be whittled from a single block of wood, in which case the hole for the forefinger is gouged out. It must reach halfway up the head.

Another delightful and simple method is to carve the head from a large potato or turnip. Cut the features boldly; exaggerate them. Large noses are cut separately and held on by pins. All will be greatly softened when covered with paste-soaked paper toweling (see P.S.M., May '36, p. 70). Five layers of paper will be found sufficient. Alternate the layers, first a layer of soft newspaper, then one of tough paper toweling. The toweling should be the final layer because it gives a fine surface for painting upon. After this has dried thoroughly, which may take several days, the potato is carefully dug out, leaving the hollow head. Fill the front with sawdust mixed with a little whiting and glue; then plaster the entire inside of head with this mixture and while it is still soft, insert a suitable tube, letting it reach

to about the eyes, which are in the middle of the normal head.

A tube foundation is needed for other types of hand-puppet heads. Simply make a cylinder of tough, flexible cardboard from 2 to 3 in. long to fit loosely over the index finger. Wrap and tie the tube with strong string, and cover it with several layers of paste-soaked paper (toweling) until it fits snugly into the neck of the head. When dry, it will be found securely anchored. Around the base of the tube is it advisable to add a

At right above are a stick puppet after the Javanese carved from balsa wood; a Mexican character with an unpeeled potato for a head; Scaramouch with a potato head covered with paper pulp; and, in the foreground, potato-carved head plastered with paste-soaked paper



Below: Policeman with stuffed head and leather hands, Toby the dog, and a doctor with stuffed rag head and hands of felt. The sketches at right illustrate a variety of methods



roll of soft muslin. This is sewed to the tube with a large needle and carpet thread. To this the garment is to be attached.

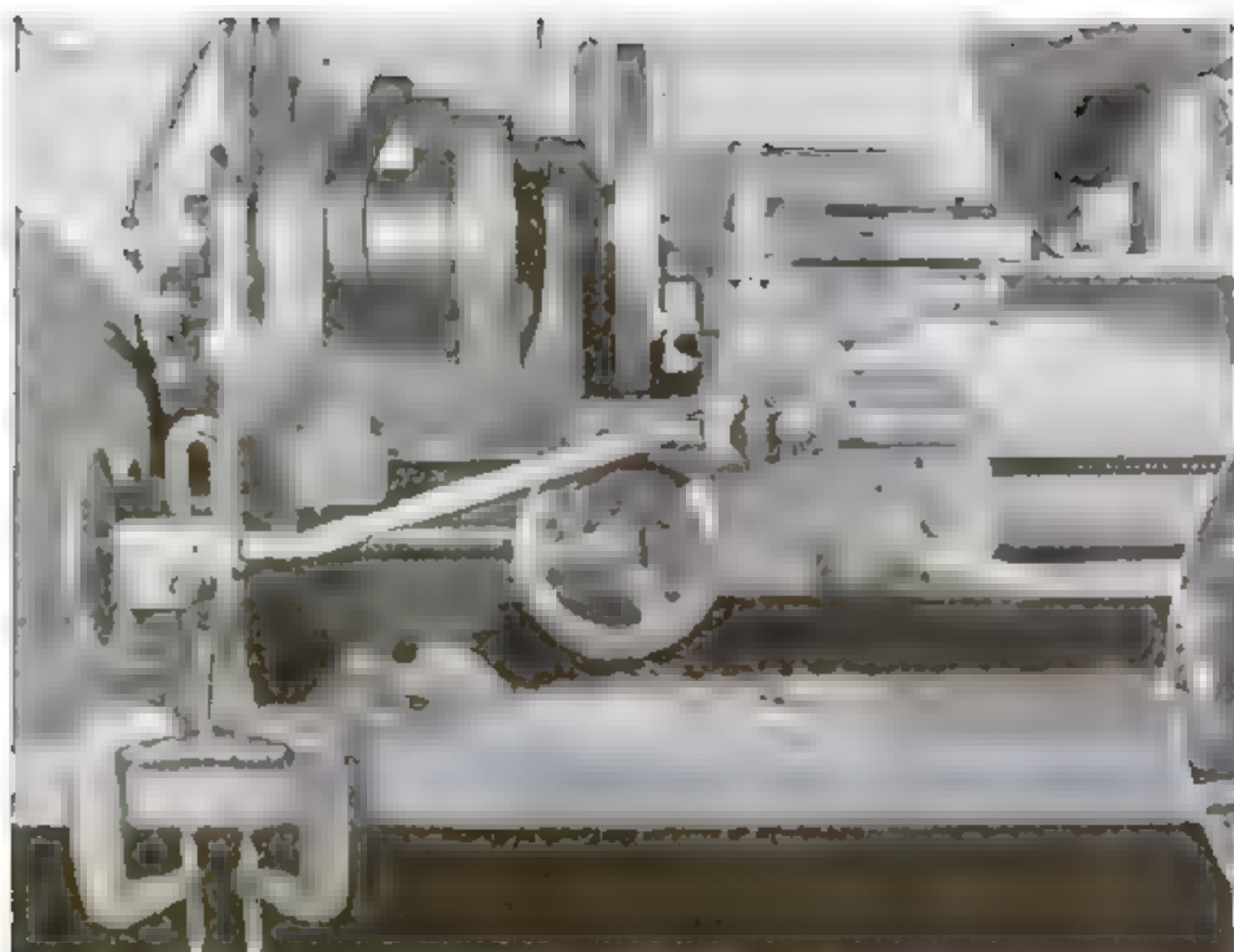
Hair, and the headdress as well, can be modeled on with pulp or carved in wood. Cotton or rags wet with paste give good effects. Wigs and beards can be made from almost anything—frayed rope, fringe, zephyr, raffia, cloth, and even metal pot cleaners. Anything, in fact, is better than human hair. Heroic personages demand sculptured hair. With hand puppets, the most elaborate headdresses can be used because there are no strings to become entangled. For jeweled headdresses, use colored gum drops pinched and cut to form the jewels of the crown. Rub the sugar coating off a bit so as to show the rich color beneath.

Hands, too, are made from a variety of materials: Carved wood for wooden-headed puppets as in the drawing of Mr. Punch. Wood pulp or cardboard, either covered with cloth or left uncovered. Wire covered with tape (see P.S.M., Feb., '36, p. 64). Felt or leather, folded and sewed as shown in an accompanying drawing.

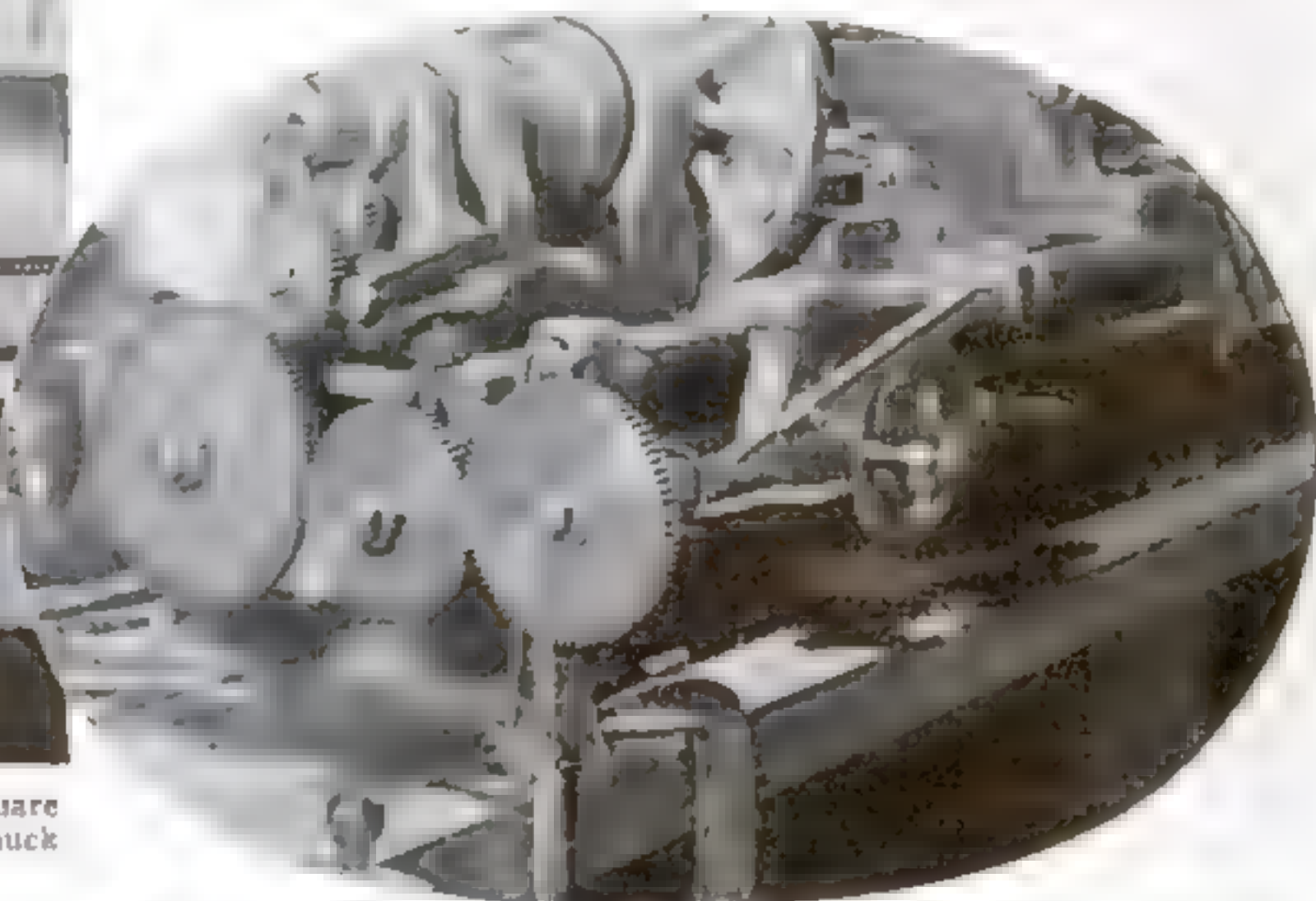
All hands should be fastened into cardboard tubes from (Continued on page 118)



Geared Cross Feed for Small Lathes



General view of the entire mechanism. Universal joints made from square tubing enable cross feed to be moved to and from the faceplate or chuck



MOST small metal lathes are not manufactured with gear-driven cross feeds, but when the inevitable job turns up that requires such a feed, the problem can be solved very easily by means of two small miter gears, 8 or 10 in. of $\frac{1}{2}$ by $\frac{1}{2}$ -in. square (inside) steel tubing, and a square rod to slide within the tubing. The necessary bracket, shafting, and clamps are to be found around most shops, so need not be purchased.

The illustrations are self-explanatory. First remove the handle from the cross feed and turn a sleeve from steel shafting to fit the cross-feed shaft. Machine the miter gear and shaft to a forced fit and attach to the shaft.

The second miter gear is held in mesh by means of a right-angle bracket made of cold rolled steel $1\frac{1}{4}$ by $\frac{7}{8}$ in. The length will be determined by the size of the miter gears. The bracket is held in position by slotting and clamping it upon the bearing extension of the cross feed as shown. A half turn of the hexagonal bolt will hold it securely.

The gears are brought into proper mesh by means of fiber washers. Power from the gear train to the cross feed is obtained by the square steel rod, which slides



One miter gear fits over the sleeve on the cross-feed shaft while the other is held in mesh by means of a right-angle steel bracket clamped on the cross-feed bearing extension

into the square steel tubing. It will be necessary to file the corners of the shaft to get a running fit. Universal joints enable the cross feed to be moved to and from the faceplate or chuck. They are made from the square steel tubing and rod as shown.

If the universal joints are made with taper-pin bearings, there will be no lost motion and no loss whatsoever in precision of the cross feed.

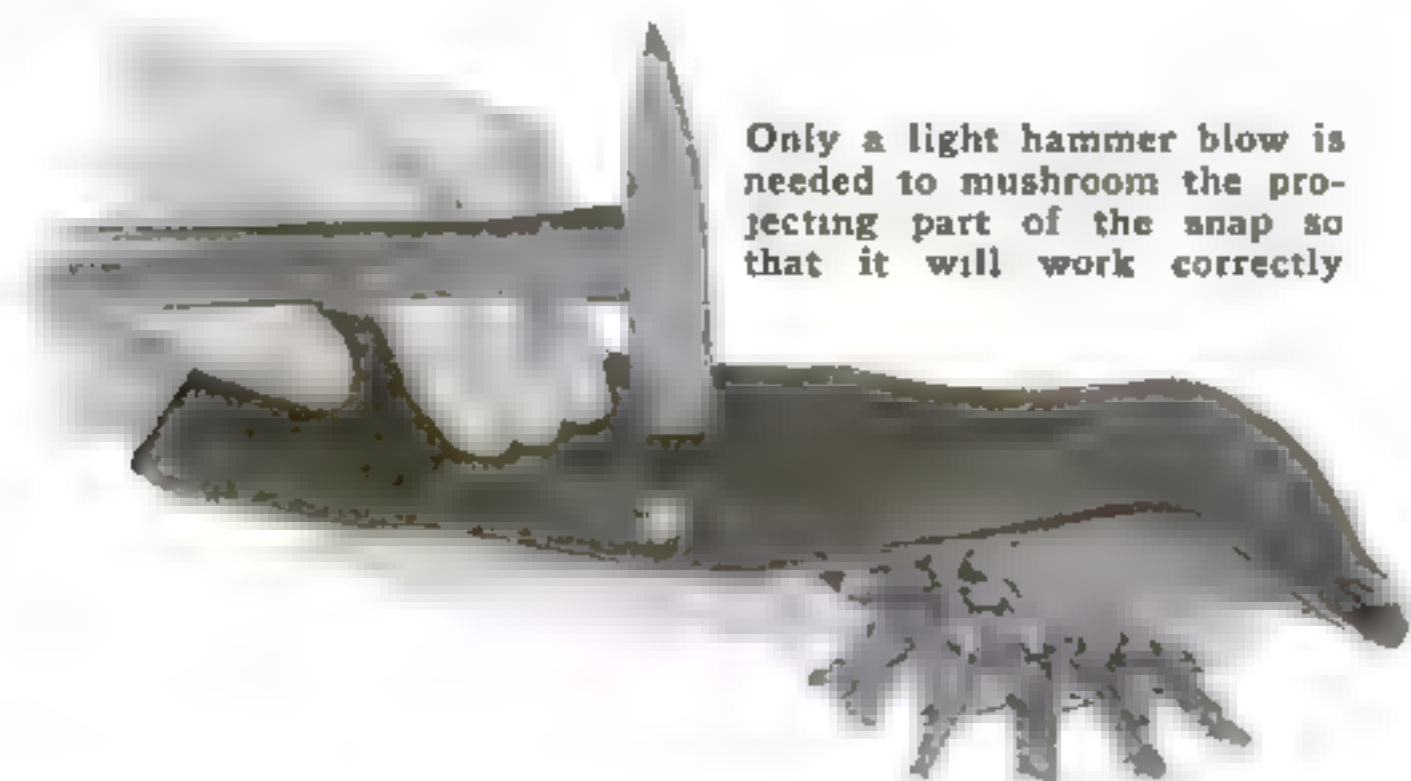
The cross-feed drive gear is held in mesh with the usual lathe gear train by a shaft passing through a piece of steel or hardwood and supported by a bracket



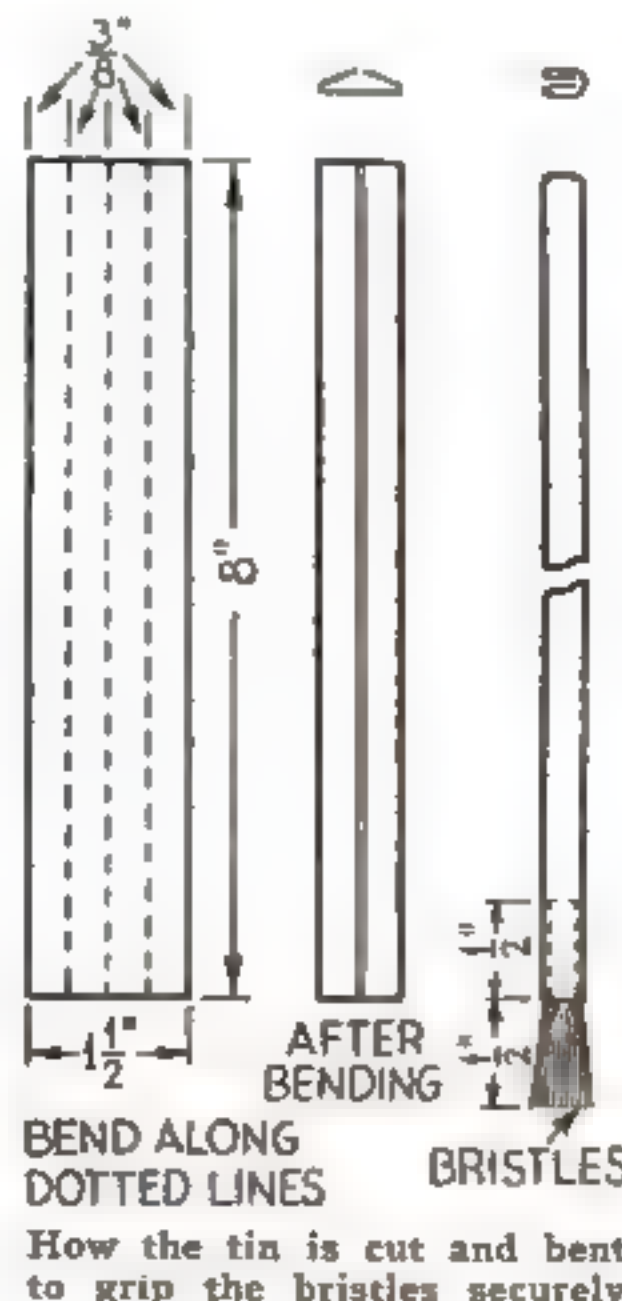
clamped to the bench as shown. By using extra gears and a little ingenuity, a wide variety of feeds across the faceplate can be obtained. Not only is the cross-feed adapter simple to make, attach, or remove, but it also serves for a variety of work that is ordinarily done on lathes costing many times the price of the smaller types with which home mechanics have to be content.—W. W. BAUMEISTER.

REPAIRING LOOSE KEY-CASE SNAP

WHEN a key-case snap becomes loose through long wear, it may be repaired by mushrooming the projecting part with a light hammer blow. This will expand the part so it will fit the socket tightly. If it is accidentally flattened too much, squeezing with pliers will bring it back into shape. Many valuable leather articles fitted with snaps of this type can thus be saved from being discarded.—D. W. PRINCE.



Only a light hammer blow is needed to mushroom the projecting part of the snap so that it will work correctly



SMALL BRUSHES MADE FROM OLD BROOM

A QUANTITY of small brushes for applying glue, shellac, soldering flux, and rubber cement or for cleaning delicate mechanisms may be made from an old brush-type broom with a fair quality of bristles and a few scraps of tin or light sheet metal.

Cut a number of tin strips as shown and scribe lines $\frac{3}{8}$ in. apart. Bend the metal along the two outside lines over a piece of $\frac{1}{16}$ -in. scrap iron. Then bend along the center line to make a V when viewed from the end. Cut a tuft of bristles at least 1 in. long and insert in each side of the V, crimping the metal with pliers just enough to hold the bristles firmly. Close the handle along its entire length with pliers; then hammer it straight with light blows and trim the bristles.—EVAN W. BAKER.



This is the card you should carry if you make a hobby of craftwork. It is issued to all members of the National Homeworkshop Guild

Guild Renews FREE Membership Offer

SO SUCCESSFUL was the free membership plan introduced by the National Homeworkshop Guild last April that the directors have voted to renew the offer for 1937. By making application in proper form, any home workshop club of five or more adult members may obtain a charter in the Guild

without the payment of a cent in the way of initiation fees, membership dues, or other charges.

Among outstanding noncommercial national organizations, the Guild is one of the very few able to provide its services without cost to member clubs. To belong to the Guild and carry its official affiliate card means that you are keeping step with the forward march of the home workshop movement.

More than one hundred new clubs were formed last year under the sponsorship of the Guild. For 1937 a goal of two hundred additional clubs has been set. If there is no Guild club in your community and if you want to take advantage of what the organization has to offer, you will find it comparatively easy, with the help of the Guild, to start a club among your friends and neighbors. A bulletin is available telling exactly what to do. It may be obtained by using the coupon on this page, or, if you do not wish to cut the magazine, just write a letter to Guild headquarters, 347 Fourth Avenue, New York, and ask for Bulletin No. 16. Be sure to inclose a large stamped and self-addressed envelope.

*Two Hundred New Home
Workshop Clubs is 1937 Goal
... One Hundred Joined in 1936*

Once your club is under way, the Program Service Bureau of the Guild will supply you with lists telling where you can obtain free moving pictures, speakers, demonstrations, booklets, and other material. These lists appear in the monthly Guild bulletins, which also contain news items of interest to clubs, book reviews, and valuable data. Job sheets giving detailed directions for making furniture, novelties, and other articles accompany the bulletins.

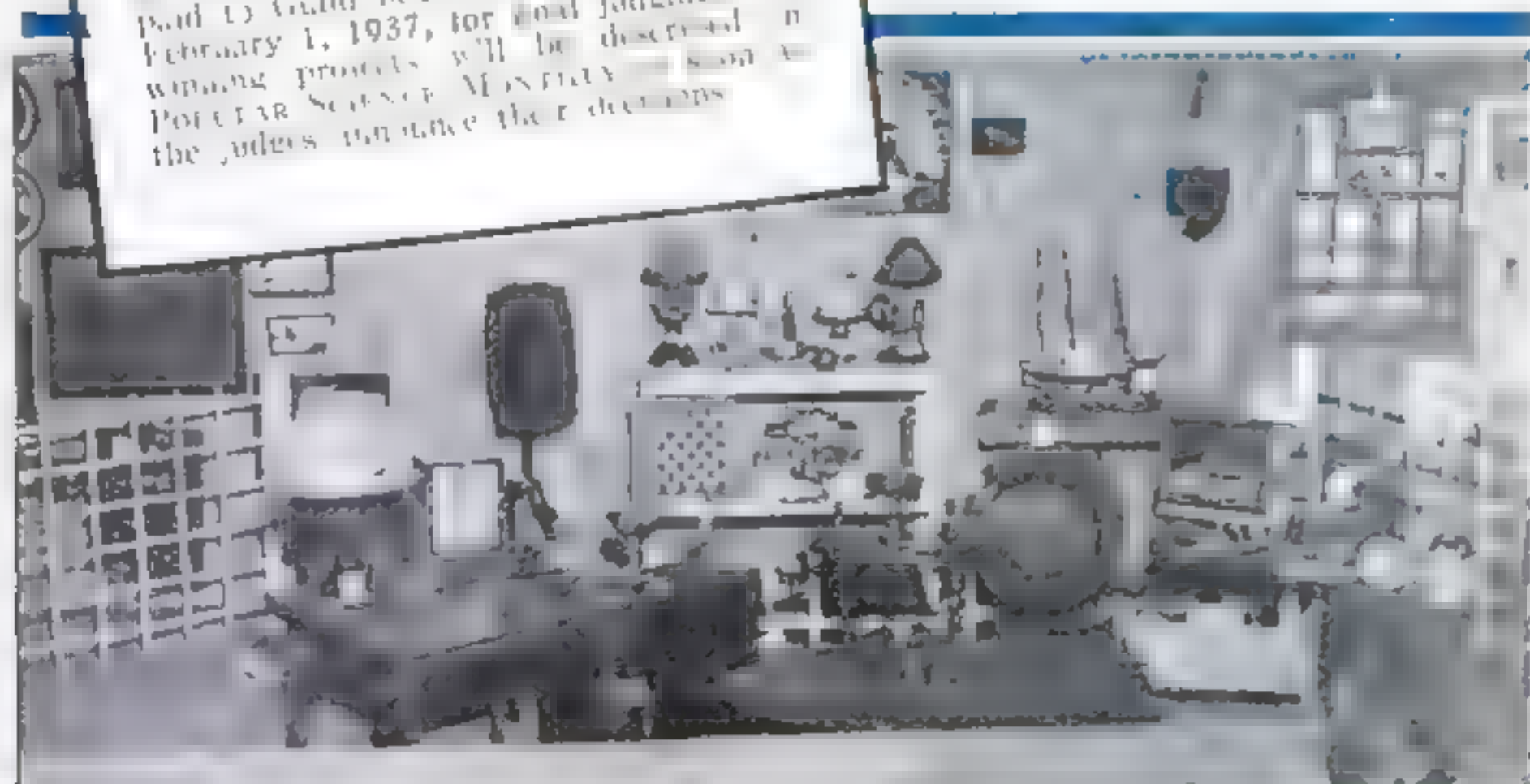
There is still time to enter the Guild's national project contest (see P.S.M., Dec. '36, p. 67) if you can organize a club at once or if you are a member of an already established club and apply immediately for a charter in the Guild. Other activities of equal interest are being planned, and you will not want to miss them, so don't delay in obtaining complete information.

The minimum age for membership in a Guild club is sixteen years. Clubs must hold at least ten regular meetings a year, and all activities must be of a type to help members maintain and develop their interest in craftwork.

Solving a Shop Puzzle Is February Stunt for Clubs

SHOP terms have been combined in a unique crossword puzzle for Guild clubs to wrestle with at one of their February meetings. Arthur J. Smith, an authority on puzzles whose work has been featured in *POPULAR SCIENCE MONTHLY*, prepared the puzzle especially for the Guild as an entertaining program feature. Copies of the puzzle will be sent to each club for distribution on the designated meeting night.

This is the third in a series of special monthly events planned by the Program Service Bureau of the Guild. The first was a National Contest Night, scheduled for December; the second, a Whittling Night for January. Clubs that participated in the contest program are reminded that all entries must be sent fully prepared to Guild headquarters on or before February 1, 1937, for final judging. The winning projects will be described in *POPULAR SCIENCE MONTHLY* and the judges announce their decisions.



Exhibition of craftwork by members of the Saginaw Homecraft Club, of Saginaw, Mich. Nearly every club affiliated with the Guild holds an annual exhibit of this type, open to the public

**National Home Workshop Guild
347 Fourth Avenue, New York**

I am anxious to join the National Homeworkshop Guild. Please RUSH Bulletin No. 16, which tells how to organize a home workshop club, where to hold meetings, how to conduct the meetings, and how to prepare the constitution and by-laws. Also include an application blank for a free charter.

Inclosed with this coupon is a large (legal-size) envelope, self-addressed and bearing a three-cent stamp for your use in sending this material.

NAME
ADDRESS
CITY..... STATE
(Please print very clearly)

RUSTIC LAMP TURNED FROM SMALL LOGS

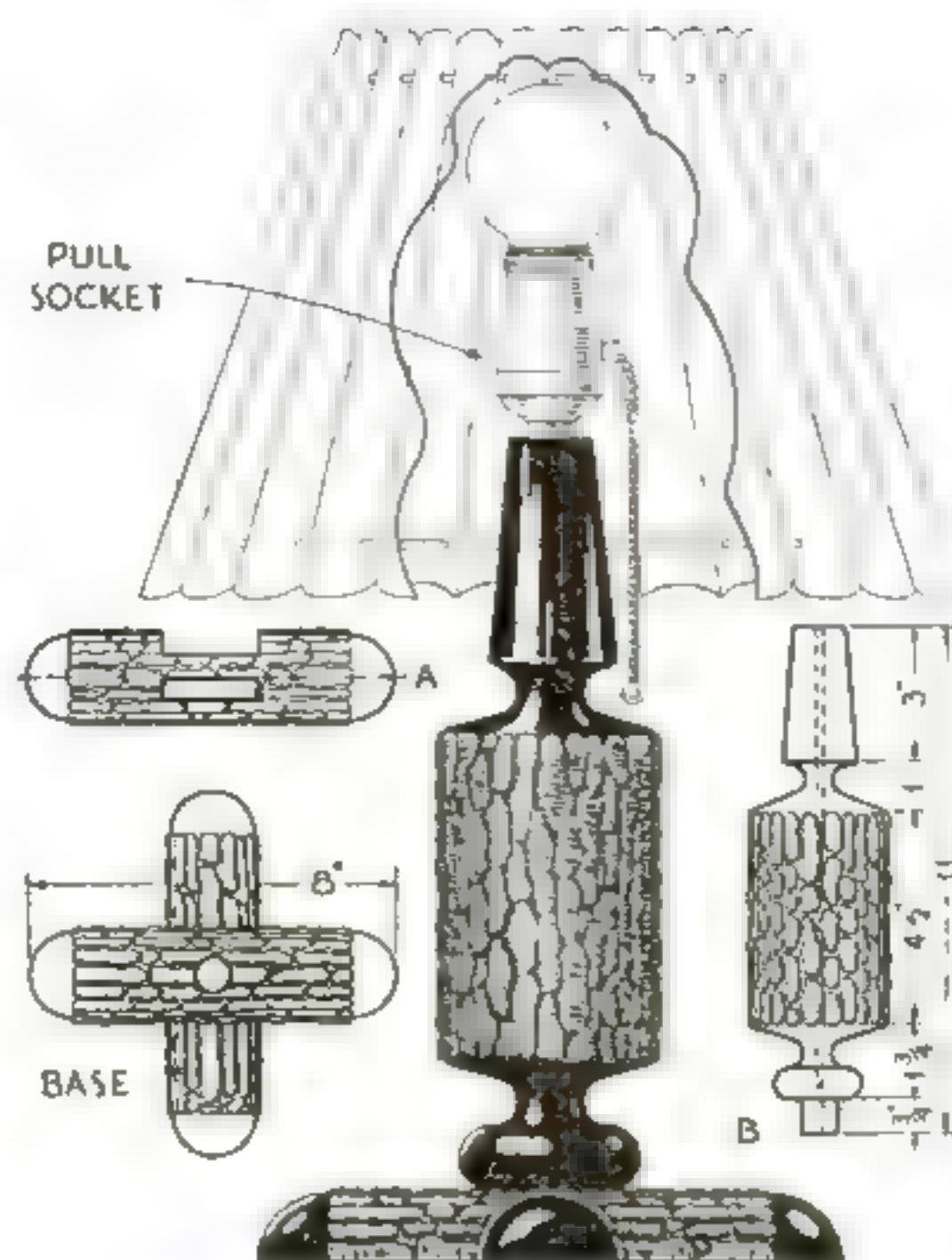
THE rustic beauty of natural bark is the novel feature of this turned lamp. Just enough turning is done to finish the ends of the base log and the pedestal.

Cottonwood, which is also often called poplar, is used because it is a tough, close-grained white wood that does not crack, and the bark does not come off when dried. The logs, however, must be cured out of doors for a year before the wood can be used.

Cottonwood seedlings can be found along almost any river or stream and they often grow beside country roads. They should be cut and stood up in the back yard for use next year. Four or five of these logs from 2 to 4 in. in diameter will provide material for several lamps and other small articles. The lamp illustrated is about a two-hour project.

A piece of log 11 in. long and 3 in. in diameter is used for the pedestal. This is turned as shown at *B* in the drawing, leaving a 4½-in. section of bark as shown. A ¼-in. hole is bored from each end through the center of the pedestal for the lamp cord.

The base log is 8 in. long and 2 in. in diameter. The ends are turned round, and the log is sawed in two as indicated by the dotted line *A*. The halves of the base log are then notched and fitted together at right angles. The tenon at the bottom of the pedestal is fitted into the ¾-in.

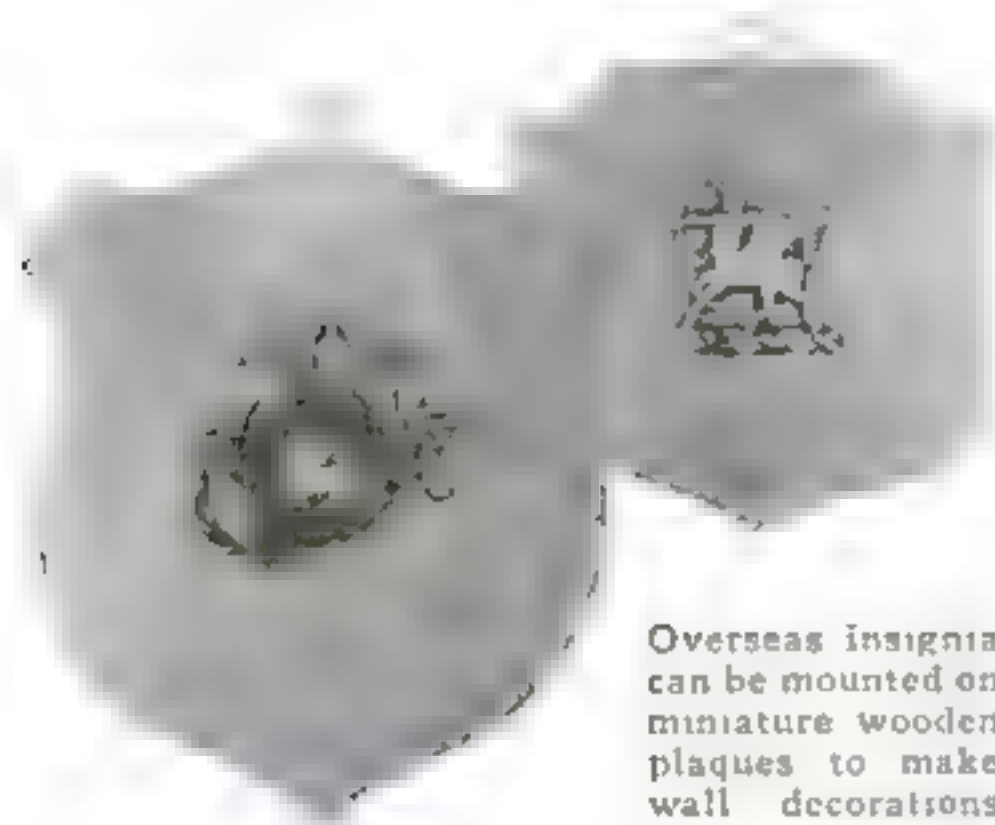


The cottonwood logs should be cured out of doors for about a year before using. The lamp itself can be made in two hours.

hole bored in the center of the base.

The turned parts are stained and varnished, and when this finish has dried, the entire lamp, bark and all, is given two coats of varnish. A pull socket is mounted at the top by means of a ⅛-in. pipe nip-

ple. A 12-in. shade is the right size to use, and it must be the bulb-gripping type. The shade should be autumn colored and preferably fluted to harmonize with the log motif. Many commercial shades of this type are available.—HAROLD JACKSON.



Overseas insignia can be mounted on miniature wooden plaques to make wall decorations.

COLLAR INSIGNIA USED FOR MAKING PLAQUES

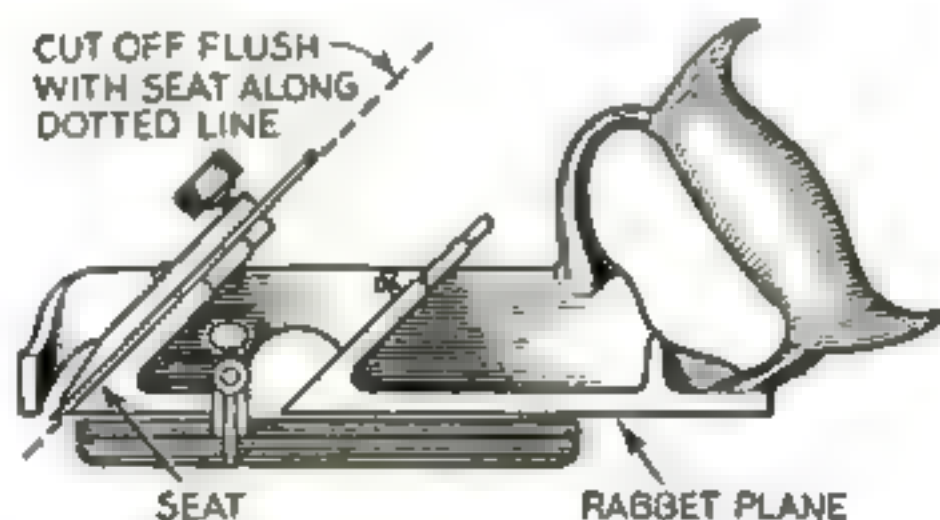
MANY home workers who are ex-service men have kept as souvenirs one or more of the small metal insignia or emblems they wore on their uniform collars or on their overseas caps or hats. When mounted on a miniature wooden plaque, an emblem of this type makes a neat wall decoration.

For the plaque, select a 4-in. square of walnut, mahogany, or other fine cabinet wood about ¼ in. thick. Sketch a suitable shield design on paper and use it as a template to outline the shape of the plaque on the wood. Saw out the design on a jig or coping saw, or whittle it out with a sharp penknife. Drill a hole for attaching the emblem and cut a depression in the back so that the nut can be countersunk.

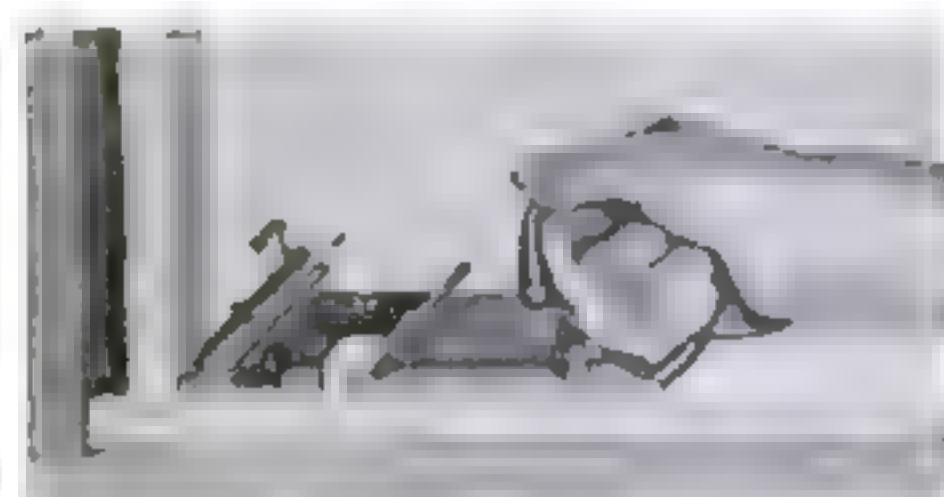
The plaque may be left natural, but it is better to stain, fill, and varnish the wood, or at least give it a coat of linseed oil or furniture wax and polish it with a cloth. Insert a small brass crew eye in the top of the plaque.—GEORGE A. SMITH.

PLANE ALTERED TO CUT INTO CORNERS

CARPENTERS and amateur woodworkers often need to plane the inside of a case, or the edges of a panel stile, clear to the corner. Some special rabbet planes with cutters 1 in. wide are very useful for panel work, and a "cabinetmaker's edge" will smooth the inside of a box, but these



Showing where a hack saw should be used to cut off the projecting nose of the plane.

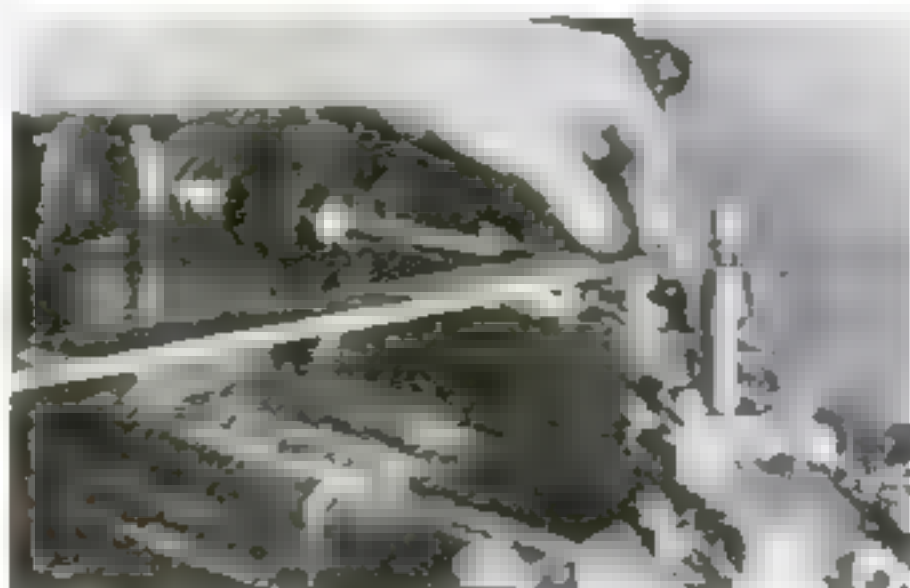


This altered plane will take the place of an expensive tool and do the work just as well.

planes are seldom available. With a hack saw, however, an ordinary rabbet plane can be turned into a satisfactory "edge" without interfering with its ordinary use. Simply saw off the projecting nose flush with the front cutter seat, and clamp the cutter there.—EDWIN M. LOVE.

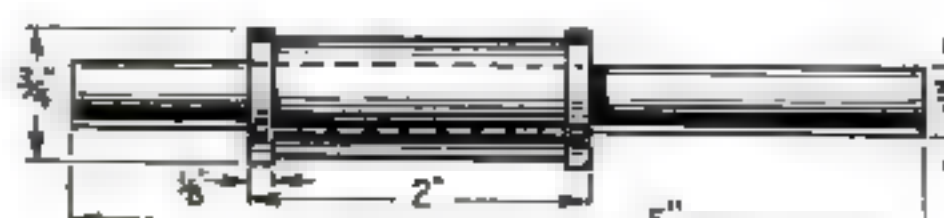
ATTACHMENT FOR FILING FLATS ON LATHE WORK

BY USING a simple roller attachment on an engine lathe, work such as filing flats or squaring the ends of small rods can be done easily and accurately without setting up a milling attachment. The device,



which consists of a small shaft and a roller to guide the file, is held in the boring tool holder.

To construct the tool, cut off a 5-in. piece of ⅜-in. drill rod for the shaft upon which the roller revolves. Next, turn the roller from a piece of ¾-in. steel rod. It has 1/16-in. flanges on each side to prevent the file from slipping off. While the rod is still in the chuck, drill the hole with a ⅜-in. drill held in the tailstock of the lathe.—BURL KNUTSON.



TAKE- APART Tennis Table

Has Self-Locking Joints



After the game is finished, this table can be taken apart in a few minutes and stored away. Unassembled, the parts appear as at the right

By Lawrence N. Olsen
and A. G. McNeill

SIMPLICITY of design and an unusual assembly make this table-tennis table especially practicable to build for home use. It may be assembled or completely taken apart in a very short time without the use of any hardware or fastenings to hold the parts in place. The joints are self-locking and resemble to some extent a mortise and tenon. When apart, the table can be stored in a comparatively small space. A table such as this, of course, might be put to a number of uses besides the game of table tennis.

Because it was to be placed in a comparatively small room, the table illustrated was made 4 by 7 ft., but a friend of the author, following the same plans, built one the regulation size, 5 by 9 ft. For the convenience of those who wish the standard table, the dimensions for a 5 by 9-ft. table have been placed in parentheses on the drawing. Where only one dimension is given, it is the same for either size table.

The table top is made of two halves, each 3 ft. 6 in. long by 4 ft. wide, or 4 ft. 6 in. long by 5 ft. wide, as the case may be. The material is three-ply wood $\frac{3}{8}$ in. thick. Large plywood dealers usually stock it in the special 5-ft. width required for tennis tables.

On one end of each of the table-top halves is fastened a wooden batten $\frac{3}{4}$ by $1\frac{3}{4}$ in. by 4 ft. long (or 5 ft. in the case of the larger table). On the underside of each of these battens is secured two $\frac{1}{2}$ by 1 by 1-in. stop blocks. These battens and blocks may be fastened with small brads, screws, or glue.

There are two long rails $\frac{1}{2}$ by 6 in. by 6 ft. 8 in. (or 8 ft. 8 in. for the larger table), with three notches in each, cut to the dimensions shown. The two cross rails are $\frac{1}{2}$ by 6 in. by 3 ft. 8 in. (or 4 ft. 8 in.), with two notches in each as detailed. The four legs are $1\frac{1}{2}$ by 2 in. by 2 ft. 6 in., notched for the cross members and dadoed $\frac{1}{2}$ in. deep for the longitudinal pieces.

The section marked A-A shows the way

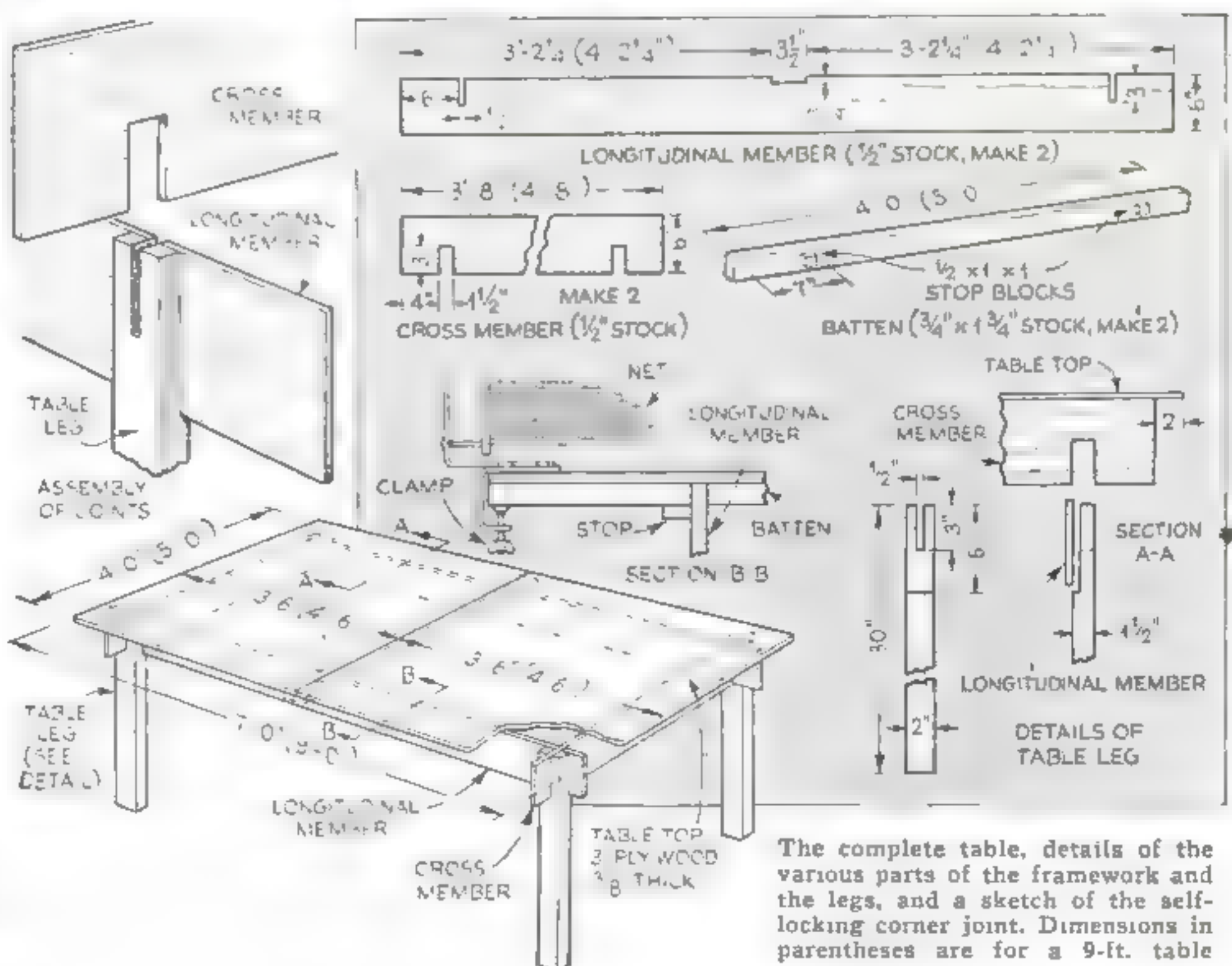
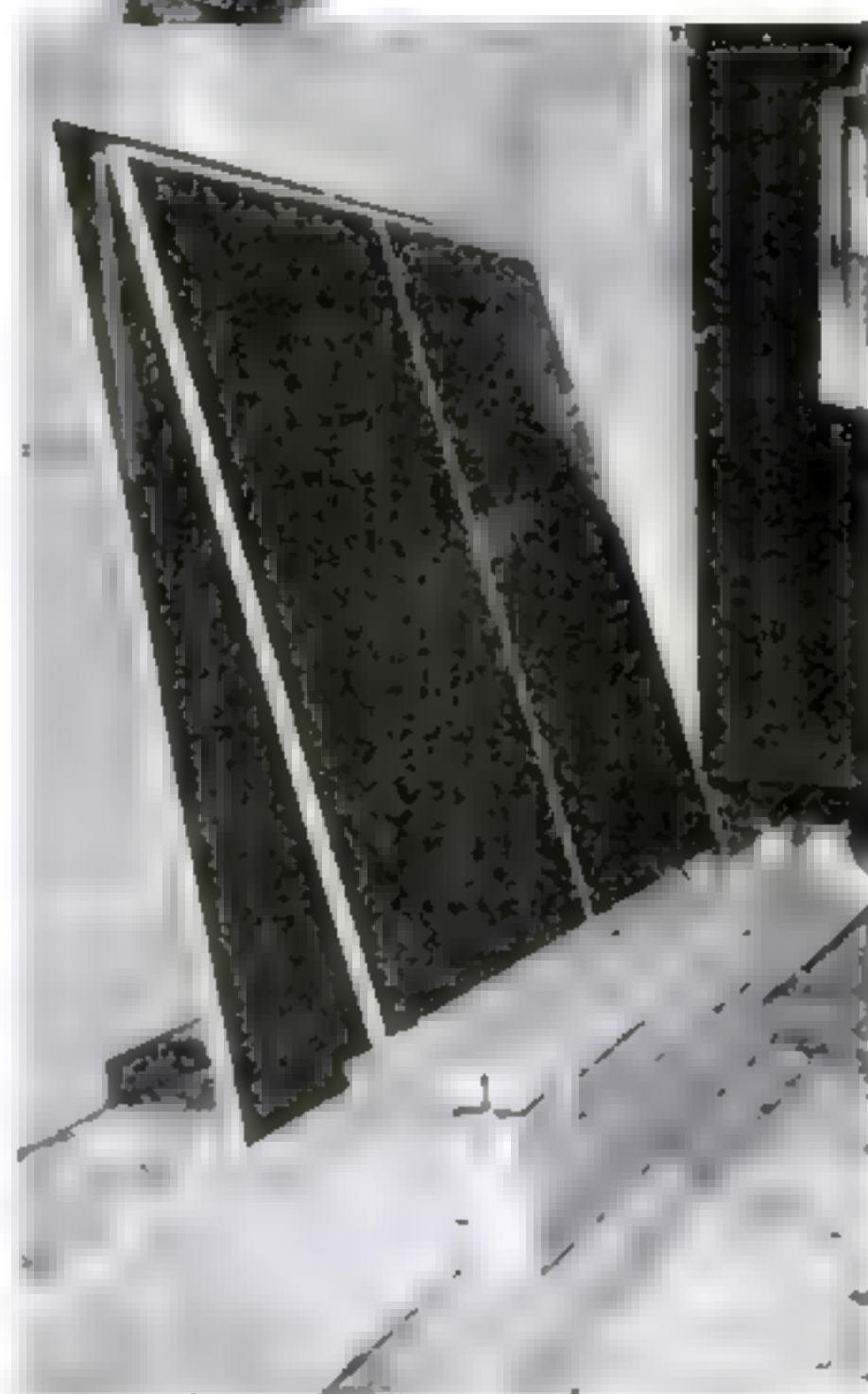
in which the legs, cross members, and longitudinal members fit snugly together to form a sturdy joint; and B-B shows how the center of the table top fits into the notched longitudinal members and is held by the small stop blocks.

If the table is stained, varnished, rubbed down, and then waxed, the finished product will be one of which you may well be proud. The painted line through the central length of the table must be applied, of course, before any waxing is

done. Locate the center of each end of the table. Chalk a piece of twine somewhat longer than the table length, secure the string to the predetermined centers, draw the string taut, then lift the twine a few inches over the center of the table and let go with a snap. The whitened twine will leave a straight line. If your hand is steady, it is a simple matter to paint a white line along the chalk mark, but to make it easier, you may fasten two lengths of masking tape on the table top on each side of the chalk line, allowing a space of about $\frac{3}{4}$ in. between them. Then paint in the space, and after the paint is dry, remove the tape.

The table-tennis net, which is standard equipment obtainable at any sporting store, is clamped as shown in section B-B.

By following the same construction, a bridge table can be made. The same legs will serve, but the top should be about 3 ft. square. If very light plywood is used for the bridge-table top, it may be covered with a waste piece of linoleum. No covering is used on a table-tennis table.



The complete table, details of the various parts of the framework and the legs, and a sketch of the self-locking corner joint. Dimensions in parentheses are for a 9-ft. table

ROADSIDE REFLECTING SIGNS EASILY MADE TO ATTRACT PASSING AUTOISTS

A **ROADSIDE** sign that utilizes the lights of approaching automobiles for its medium of illumination may be constructed at a cost only slightly higher than that of the ordinary sign. It is rather difficult to ascertain the advertising value of one of these signs to the average proprietor of a filling station or refreshment stand, but when, as has been the case, an otherwise mediocre evening trade develops into a brisk, prosperous business coincident with the placing of a reflecting-type sign, certainly that sign has had something to do with attracting the roving autoist.

As shown in the drawings, the back of the sign consists of boards cut to whatever size is required to carry the message—in this instance 24 by 36 in. The panels are 6 in. in width and the letters 5 in. in height, with a 1-in. stroke. It is advisable to proportion the stroke from a fifth to a sixth of the letter height in all signs, with an approximately equal space allowance between the letters.

The letters themselves are outlined on mirror glass or highly polished stainless steel or other nonrusting metal, and the spaces between the letters are then filled in with an opaque paint or lacquer. The panels should be large enough so that molding may be placed around each edge, as shown. Mirror-glass panels should have a coat of shellac on the back to keep moisture out.

The illustration in the upper right-hand corner shows how one of these signs appears at night. It is clearly legible even at a distance of several hundred feet, providing headlights are shining upon it.

Other methods of painting may be used;

for example, the letters can be black and spotted with a series of large bright, round dots which, when illuminated in the dark, appear like miniature lamps. The letter I, for example, could consist of five of these bright spots, one above the other.

Reflecting-type signs should be erected so that their centers are about 42 in. above the roadbed. They should, for the safety of the autoist, be placed at least 4 ft. from the edge of the road and at a slight angle so that the reflected light will not shine back into the eyes of the driver and other occupants of the car. It is preferable, but not necessary, that the signs be placed near a curve, for by so doing they are illuminated for a greater length of time,



How the sign appears to motorists. It should be placed as indicated at the left, preferably near a curve

thus insuring a better chance of their being seen and their message read by the autoist.

It will be necessary to determine by experiment the exact angle at which the signs should be placed to obtain a satisfactory reflection.—P. H. SMITH.



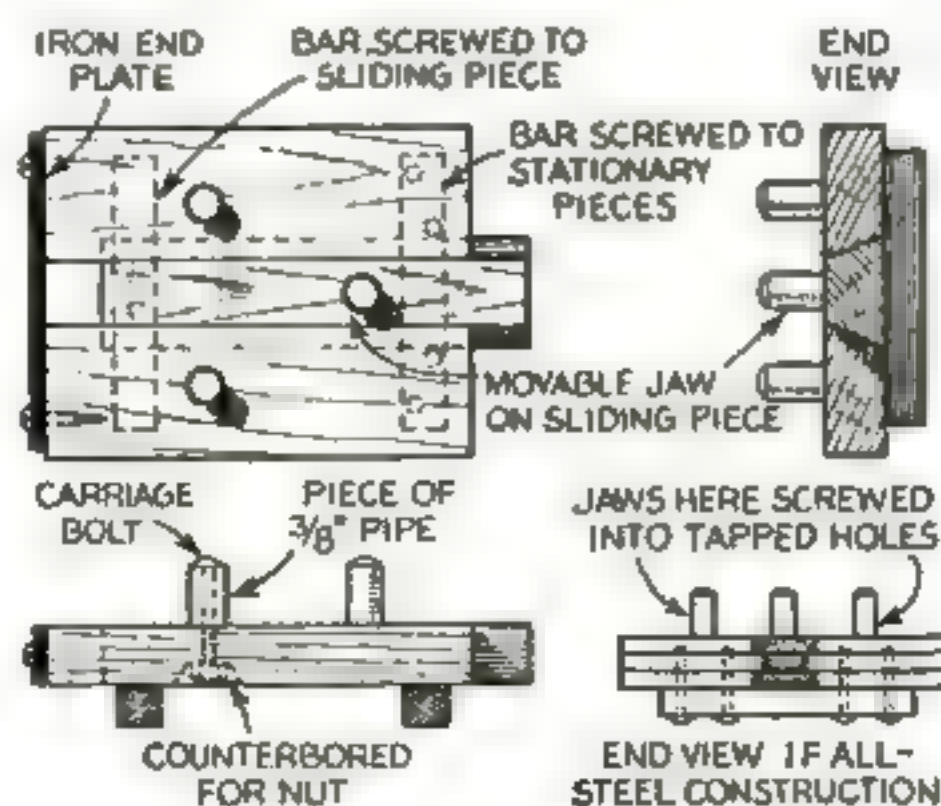
The letters, on three panels 6 in. wide, are left bright against a black-painted background

MINIATURE SPOKESHAVE FOR BALSA MODELS

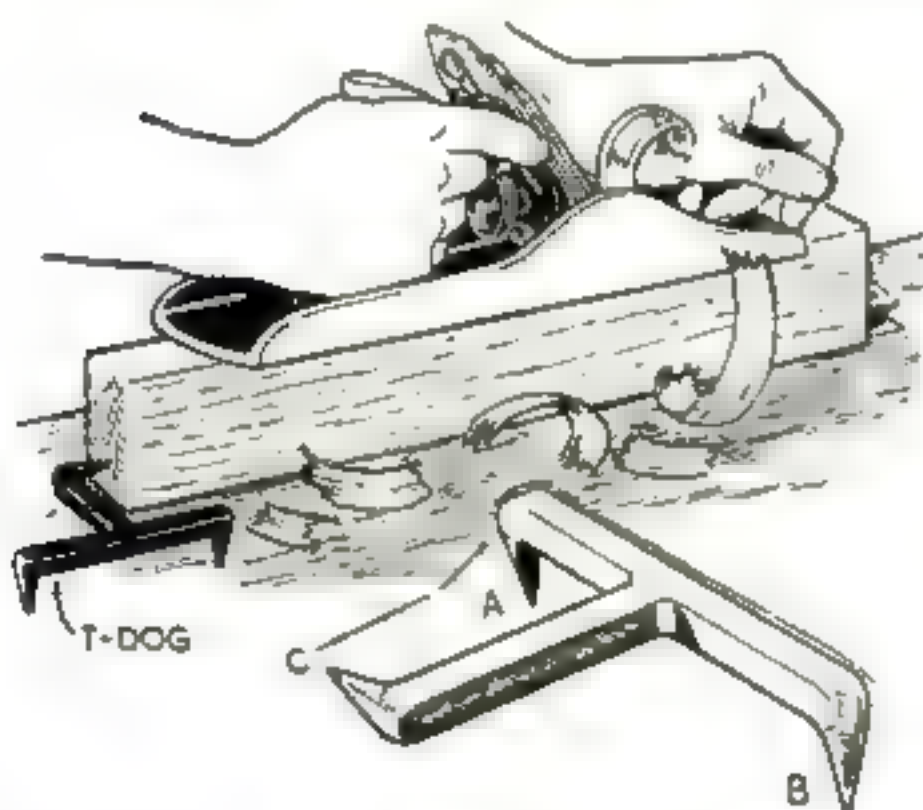
AN **INEXPENSIVE** safety razor with a double-edged blade of the curved type serves as an excellent little spokeshave for the preliminary shaping of hulls and other parts of ship and airplane models made of balsa wood. It is used exactly as in shaving, and the guard prevents digging in too far with the blade. The tool takes a clean cut and does not injure the soft fibers of the balsa.—GEORGE R. MARTIN.

QUICK-ACTING JIG FOR AUTO PISTONS

THE small jig shown below is very useful for clamping auto pistons or similar hollow cylindrical articles without danger of injuring them. It is actuated by the bench vise and holds at three points. As the vise jaws are brought closer together, the movable jaw of the clamp moves farther from the two fixed jaws.

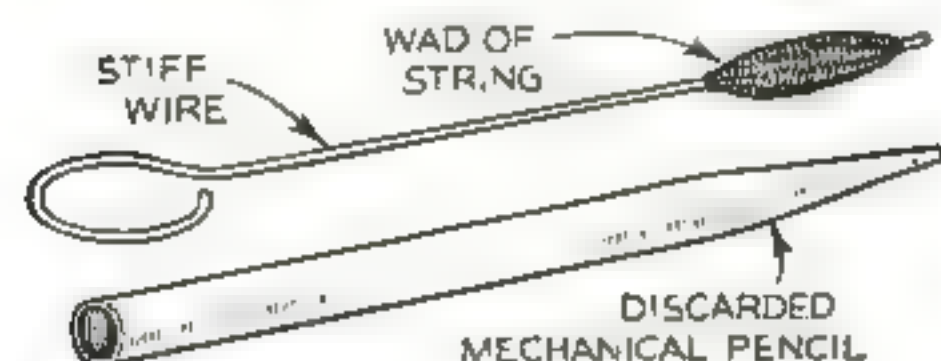


The piston or similar hollow cylindrical part is held internally by the pressure of three pins



T-DOG AIDS IN PLANING SHORT PIECES OF WOOD

SHORT pieces of wood can be planed more easily on the bench with the aid of a T-dog or hold-down of the homemade type illustrated above. It can be made on an anvil in thirty minutes and will last a lifetime. The wood is tapped securely against the usual bench dog. Point C of the T-dog is then driven into the end of the piece, and points A and B are driven lightly into the bench.—C. E. LIBBY.



TINY GREASE GUN MADE FROM OLD PENCIL BARREL

A **HANDY** little grease gun for neatly and speedily greasing model railway engines and other small moving parts may be made from an old mechanical pencil, as shown at the left. To make the plunger, bend a piece of stiff wire into the shape

illustrated, and around the end bind some string or electrician's tape to form a wad that will slide in the barrel. Fill the pencil with grease and insert the plunger. A slight pressure will squeeze the grease out with force.—JOHN C. CRAIG.



MINIATURE Battle-Cruiser Turret HOLDS CIGARETTES

By William J. Turnbull, Jr.

HERE is a sturdy cigarette container the prototype of which will be found on the decks of Uncle Sam's 10,000-ton battle cruisers of the *Houston* and *Chicago* type. As a reasonably accurate scale model of a triple 8-in. turret, it is a project that will hold its own with any boat model on the mantelshelf.

The guns may be turned from wood or metal, tapering uniformly from the recoil cylinder at the butt to within $\frac{1}{8}$ in. from the business end, where they are very slightly belled. With wooden guns, the recoil cylinder should be of brass tubing to enable them to be trimmed off evenly inside the turret after being soldered in place. A

substitute method, which does not detract from the appearance, is to use three sizes of brass tubing telescoped one within the other, starting with $\frac{1}{4}$ in. inside diameter.

Although the real guns may be elevated individually, they usually appear in the same plane, so it is best to keep that alignment. Any angle from the horizontal to 5-deg. elevation is suitable.

The exterior of the turret should be fabricated from sheet brass not more than $\frac{1}{32}$ in. thick. The sides are flat and rolled to a flat top, which slants toward the forward end. Because of the holes that will be required for ladders and doors, it is easier to prepare a pattern and do all of the hard work while the metal is flat. The hole for joining the "ears," however, should not be finished until the turret is shaped. Unless an expert pattern maker is doing the work, it is suggested that the curved back be made to proper size and shape be-

fore being placed. After the back is well soldered in place, the sides can be neatly filed to a smooth joint and the edge slightly smoothed off. The same general treatment applies to the forward end.

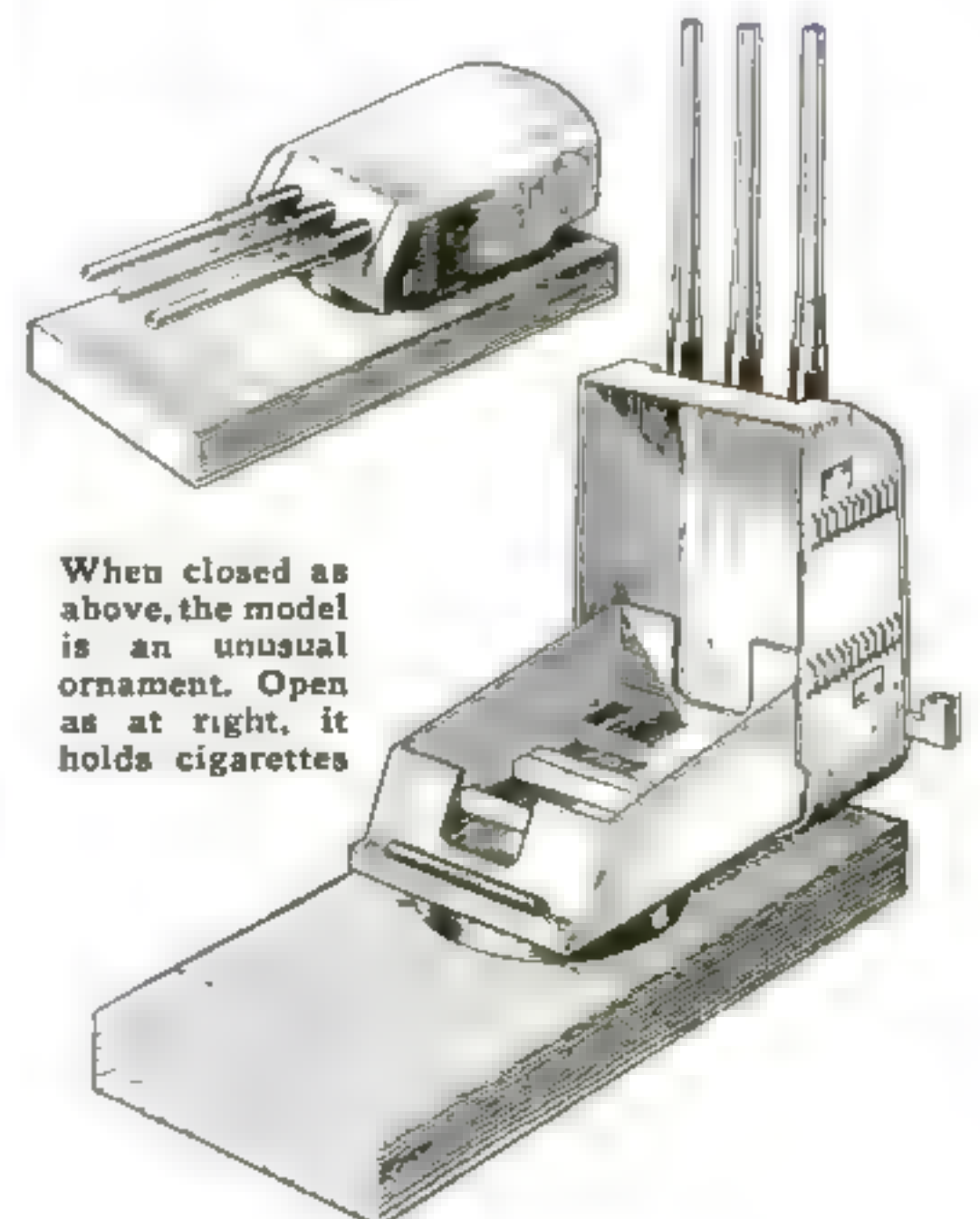
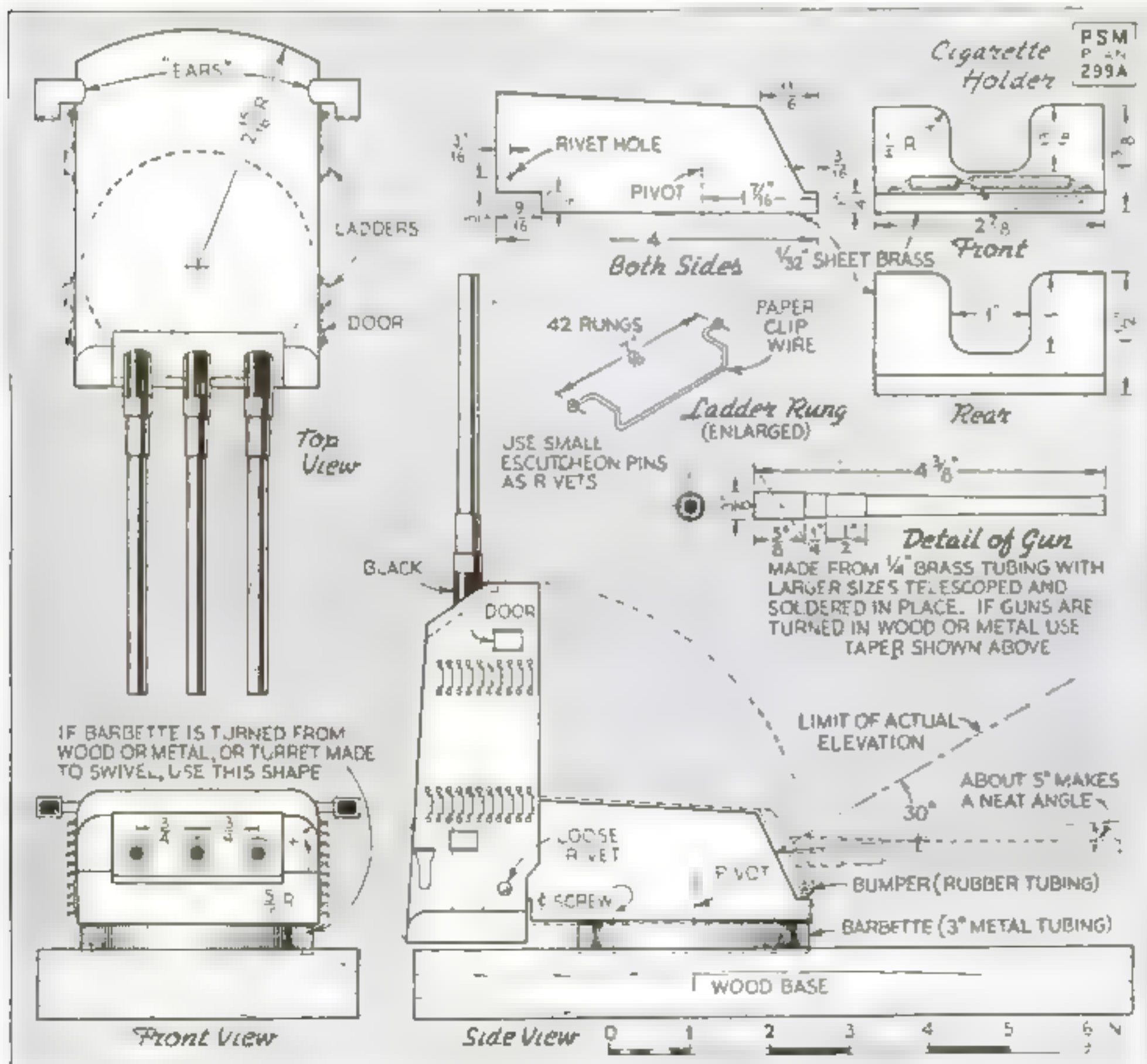
A small ventilator has been purposely omitted from the drawings. It should be in line with the starboard gun and about two thirds the distance from the forward end of the turret. If it is desired to add this ventilator, it could be of $\frac{1}{8}$ -in. tubing, $\frac{3}{4}$ in. high, with a $\frac{3}{16}$ -in. opening facing the guns. It is hardly noticeable on the prototype, so may be omitted.

The four ladders may be omitted from a simplified or elementary model, but their presence enriches the appearance enough to justify including them.

Actually the rungs are riveted to the sides through rings at either end, as shown on the drawing. This can be done by using a very small escutcheon pin such as those found in ship model kits. Although common pins do not have the correct head shape, they also are suitable. Use a large pin and drill holes small enough to make it necessary to hammer the pins home. This will eliminate solder and provide a neater finish both inside and out.

A suitable substitute method, which makes it easier to insure uniformity, is to get a strip of wire brads such as are used in a paper-stapling machine. Most stationery

(Continued on page 110)



When closed as above, the model is an unusual ornament. Open as at right, it holds cigarettes

Top, front, and side views of the assembled model, the latter with the gun turret raised to give access to the cigarette container. Details of guns, ladders, and cigarette box are also given

SIMPLY BUILT Breakfast-Nook



you lack the tools or question your ability to make a good edge joint on any reasonable length of material, buy the material already glued up. In any case, see that the dowels are placed so that they will remain in the material to be used and not cut out with the waste. Note the dowel location in the cutting plan.

After marking all bench ends, cut them out and spokeshave all edges smooth. Use light, fast strokes; they hit the high spots and give a nicely dressed contour. Next sandpaper and generally clean up the ends, which will be found easier to do at this stage. If, when sanding, you remove some of the penciled locations, retrace them from the punch marks. For sanding the curved edges, a piece of heavy sponge-rubber kneeling pad tacked around a scrap of wood makes an excellent sandpaper block. It "flows" around the corners and leaves all edges pleasant to handle. It is important to see that all corners are well rounded off because they will then take either paint or enamel better than if left sharp, and will be found much more com-

IN THIS breakfast-nook furniture, all unessential and fancy details have been eliminated in order to make the set easy to dust and keep clean. The construction has also been simplified so that the comparative novice need entertain no fears as to whether or not he can do the job. Remember, however, that in all woodworking simple work requires accuracy as well as the more intricate. Careless and slovenly work has no place in the shop if the product is to stand inspection and possess durability.

The table itself is of an excellent, sturdy design, and will fill all general purposes quite well, should the worker have no desire to build the complete set. Incidentally, the table is easier to construct than the common four-legged type.

The quantity and sizes given in the list of materials at the end of the article have been determined under actual working conditions. While the bench ends might be cut from slightly narrower stock, with corners and noses joined on afterward, it will be found that what is gained after a certain point is more than offset by the necessary increase in labor.

Bench construction. Make a full-sized

pattern of a bench end from very heavy paper or cardboard. Mark on this pattern the location of all cross members, seat batten, and seat. Place the pattern on the already jointed-up material in one of the two positions shown on the cutting layout. Trace the outline; then with a sharp-pointed instrument such as a scratch awl, punch prick through in such a manner that you may remove the pattern and, by connecting the pricks, mark the location of seat, rails, and the like. Do the same for the other bench ends, but when selecting the sides of the material, remember these ends are to be made in pairs.

A hint on the jointing up (or edge planing) of the bench-end and table-top material may not be amiss, particularly for the beginner. Edge jointing requires infinite care and pains, and if



All the parts of the set except the table top are sanded before they are assembled, either by machine or hand. Take care not to bruise the wood in later operations

The bench rails should be doweled at each end as illustrated at the right. Center the $\frac{3}{4}$ -in. dowels from $1\frac{1}{2}$ to 2 in. from the end of the rail

Furniture

By
REGINALD O. LISSAMAN

portable when the set is in use. Now fasten the seat battens in position by screwing through the batten (see list of materials for sizes of screws). Drill and countersink ready for the screws to go into the rail ends, and then lay the ends aside till needed.

The "two-by-four" cross rails go three to the bench. Be sure they are all cut to equal length, with the ends perfectly square both ways. In the poorer or bottom edge of all three, drill for and place (with glue) $\frac{3}{4}$ -in. dowels as shown in a photograph. Each dowel is placed $1\frac{1}{2}$ or 2 in. from the end of the rail—two dowels to a rail. They will give an excellent grip for the screws that will later come through the bench ends into the ends of these rails, holding the bench together. Now lay aside the seat rail, and rabbet the remaining two of each set, one in the upper edge, the other (which will be the top rail) in the lower edge. The top rail is next given a half-round nose on the upper edge. This completes the work on the rails.

The bench seat plank

Right: Assembling pedestal end of the table. Wherever dowel holes will not show, time is saved by putting the dowels in from the outside. Below: Nailing V-joint stock in the back frame of a bench



is cut to length (exactly same length as the rails), and one end may, if desired, be slightly undercut to permit placing it more easily later on. The front edge is round-nosed, and thoroughly cleaned and sanded.

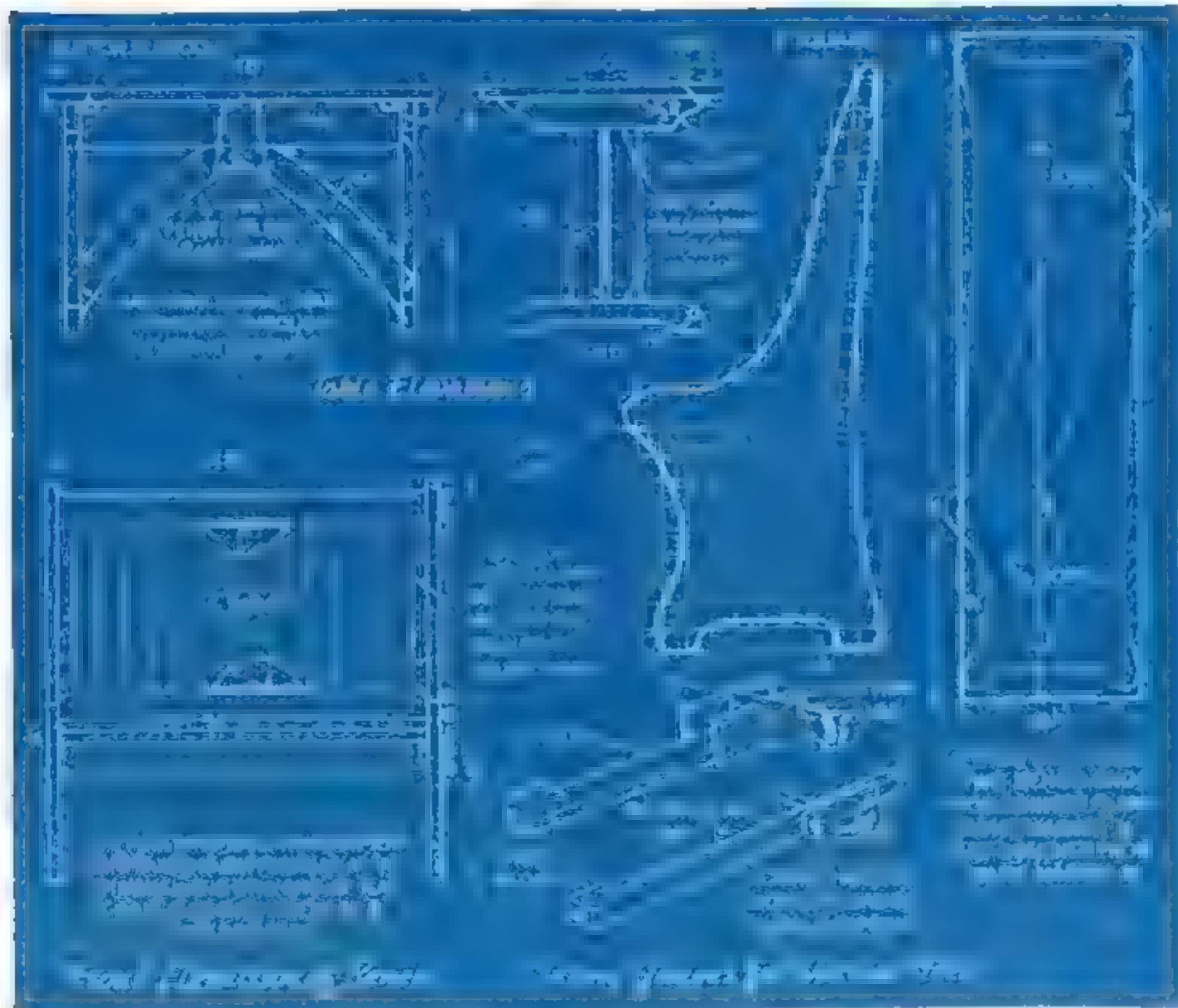
Bench assembly. This is an awkward job if you are working single handed, but affords a good opportunity to get the wife interested in your hobby and obviates the necessity of having to impose on the good will of a neighbor or friend by asking for his assistance. When the assistant arrives, have him or her hold the rails against their location marks on the bench ends while you tack them in place with $2\frac{1}{2}$ -in. finishing nails and get the bar clamps in place. When placing the clamps, take care to protect the work from the jaws with either pads of scraps of wood. Make sure that top and lower back rails are in line and equally spaced at each end, so that all the V-joint material may be cut to the same length. Now drive home all the screws, setting them in a little more than flush so they may be stopped over later with either putty or a plastic composition wood.

The V-joint stock is now cut to length and nailed in place with $1\frac{3}{4}$ -in. finishing nails as in a photograph. Should your circular saw not possess a length-cutting gauge, or if you are forced to cut the V-joint boards by hand, a suitable gauge may be made by one of the methods suggested in an accompanying sketch.

When using V-joint stock as a panel (or for a door), always lay out the widths along the rails and arrange the material in such a way as to have the starting piece equal in width to the finishing piece. Nothing spoils the appearance of a V-joint panel more than to see the first piece of full width and the last piece a mere sliver. To place this material between uprights as in this case, fold the last three or four pieces into place and then nail, rather than nail all but the last and try to force or squeeze it into place.

The seat has now to be put in place. Locate the square-cut end and gently tap the undercut end down, using a block over the seat to prevent any bruises. Now nail the seat securely and remove the clamps.

Table construction. The four pieces for each pedestal end are cut as shown in the drawing. Make sure that all edges are



The drawings. In front view of table, the 1 by 6-in. beam and the braces pass through flush with the outside at points Y, and the beam is let into the cross member $\frac{1}{2}$ in. at point X



The beam and brace of the table pass through the space between the uprights. The screw driver at left points to groove marked X in drawings. The pedestal cross members are grooved beforehand so the table top can be fastened on with wood buttons as shown above.

dressed square with the sides. Spokeshave and sandpaper all curved edges. The faces are sanded after assembly to dress down any slight joint irregularities. These parts are now laid down on a good flat surface and clamped together as shown. Note the spacer pegs between the two upright members. The pegs serve to keep the uprights exactly $\frac{3}{4}$ in. apart to allow the cross beam and braces to fit into this space later.

When the pedestal has been clamped firmly together with all parts in place, the holes for the dowels are drilled. Coat both hole and dowel with glue and drive the $\frac{3}{4}$ -in. dowels home. The dowels in the lower or foot cross member are cut off flush with the outside, but those in the upper joints are cut before inserting to such a length as will permit them to pass only half through that member when in place. They are driven into position with a piece of $\frac{1}{2}$ -in. rod. This type of dowseling and the reasons for it were explained in a previous issue (P. S. M., Aug. '36, p. 70). If you wish to proceed with the work at this time, you may do so by pinning all the dowels on either side of the joint with a $1\frac{1}{4}$ -in. finishing nail driven through the dowel from the inner face of the pedestal, otherwise you will have to wait for the glue to set before the clamps may be removed.

Now cut the groove located at X in the table drawing across the inner side of the top member, $\frac{1}{2}$ -in. deep and in line with the space between the two uprights. This is for the beam end to rest in. Except for the sanding and cleaning up, the work on one pedestal is now complete. Make the other pedestal in the same way.

The pair of braces for the table are next in order. These, in the original, are cut with a sweeping curve. (The worker may, however, save this work, if desired, and make them straight.) It is not necessary to scribe a true segment of a circle; just spring a good straight-grained narrow ripping to the desired amount of curve and trace the outline onto the work with a pencil. Cut along this line and spokeshave true; then set the marking gauge

to the desired width and scribe the opposite margin. Spokeshave the second edge of the brace.

The completed brace may be used as a pattern for the second. When using one piece of work as a pattern from which to cut more, always place the pattern piece face down on the face side of the material to be used and trace the outline. The reason is if the saw has "run," as it is likely to do, particularly in coarser work such as when cutting rafters, the back edge does not represent the true outline, but the face does. Not only that, but the piece so marked will be the mate or matching piece of a pair. If you needed several pairs of right- and left-hand pieces, you would use the two first pieces as the pattern pair, from which all the rest might be marked.

Table assembly. The crossbeam is fastened first. The pedestal legs are set square from the beam, and then the braces are fitted and fastened. Where the beam and braces pass between the upright members, they are nailed or screwed to the uprights. A plate of $\frac{1}{4}$ -in. three-ply paneling on either side of the junction of braces and beam fastens these members securely together.

After the frame is assembled, the jointed-up table top is squared up, and the edges are dressed. The top is surfaced after assembly. The top is laid, underside up, on the floor and the frame placed upside down on top in its correct location. The top and frame are then fastened together with buttons as illustrated in a photograph. The top is fastened in this manner to allow it to shrink in width. The buttons slide along the groove, whereas the top itself would split if it were fastened immovably to the frame. Unfortunately, it is impossible always to obtain thoroughly seasoned lumber, but if the builder makes suitable allowance, the shrinkage becomes of little consequence.

Finishing. Before any painting is commenced, the set is again gone over and smoothed with fine sandpaper. The stopping up of all nail and screw holes is done after the first, or priming coat; and if

putty is used, painters' putty*, if available, is to be preferred to glaziers' putty as it has not the same tendency to cause a discolored spot later, as will glaziers' putty. The choice of paint or enamel will rest with the builder, and much has appeared in this magazine from time to time regarding their application. A suggestion, however, as to trim: fine line decoration requires much actual practice before one's work will stand close inspection. In order, however, to break up the appearance of too much of one color, a panel of light green was sponge-stippled on the table top and bench seats. This was found to enhance the appearance. A stencil was cut out for one corner and used progressively at each corner. The corners were connected by using

a straightedge to stipple along, and then the center was filled in. This stipple panel on the cream background gave almost the appearance of a colored lace cloth.

The stippled panels are so nearly the same tone as the remainder of the surface that they do not show clearly in a photograph, but they are simply rectangles with the corners cut off in a quarter circle by means of the stencil just mentioned.

*Whiting mixed with bleached (white) linseed oil. It has less oil than glaziers' putty. Two parts whiting, one part white lead, and linseed oil may be mixed for a homemade putty. The best practice is to wait two or three days after applying the putty before resuming the painting.

List of Materials

- *2 pc. $1\frac{1}{4}$ by $18\frac{1}{2}$ in. by 6 ft., for bench ends (two ends are cut from each piece).
- 2 pc. $1\frac{1}{4}$ by 14 in. by 4 ft., for bench seats.
- *1 pc. $1\frac{1}{4}$ by 30 in. by 4 ft., for table top.
- 2 pc. 2 by 4 in. by 8 ft. dimension stock (dressed four sides), for cutting table pedestals.
- 2 pc. 2 by 4 in. by 12 ft. dimension stock, for cutting bench rails.
- 1 pc. 1 by 6 in. by 10 ft. dimension stock, for table beam and braces.
- 15 pc. 1 by 4 in. by 4 ft. V-joint stock for back panels of benches. (These may be what are called cedar "shops" or "shorts," if obtainable; they sell for less than the longer lengths.)
- Seat battens and table buttons are cut from scrap pieces left over.
- Note: The $1\frac{1}{4}$ -in. material is pine sash stock, the dimension material, either pine or good quality spruce. The pieces marked with an asterisk (*) are joined to the widths mentioned from random widths.
- Dowels: About 6 ft. of $\frac{3}{8}$ -in., for joining the $1\frac{1}{4}$ -in. material, and 10 ft. of $\frac{3}{4}$ -in., for the table pedestals and bench rails.
- Nails: 1 lb. each of $2\frac{1}{2}$ - and $3\frac{1}{2}$ -in. finishing nails; $\frac{1}{2}$ lb. of $1\frac{1}{4}$ -in. finishing nails.
- Screws: 1 doz. $1\frac{1}{2}$ -in. No. 9 or 10 flat-head bright wood screws, for table buttons; 1 doz. 2-in. No. 12 or 14, for seat battens; $1\frac{1}{2}$ doz. 3-in. No. 12, for benches.

HOMEMADE Electric Anemometer

REGISTERS VELOCITY OF WIND

By
Charles
A.
Laird



The finished anemometer mounted on a pipe support. Two wires run down and connect with an indoor indicator

AT LARGE airports, U. S. Weather Bureau offices, and observatories, the anemometer or wind-velocity indicator with its spinning cups is always an attraction. The one to be described is capable of indicating wind velocity with accuracy, and it may be placed at any reasonable distance from the actual indicator, which is an ordinary electric buzzer.

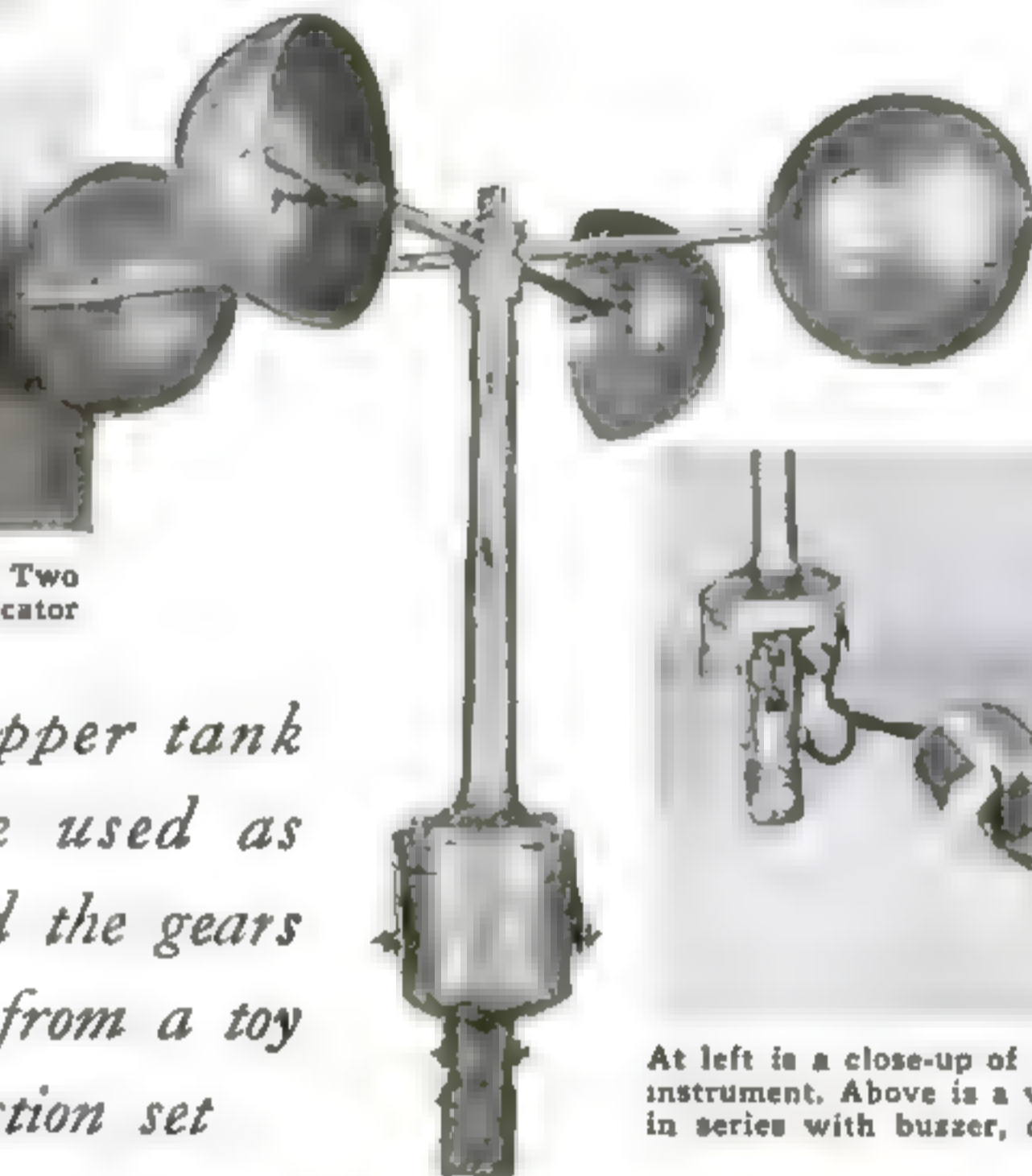
The cups in this model were made from copper flush-tank bulbs or floats, which cost about twenty cents each. You will need two of them, and they should have a diameter of 4 in. (the standard 4 by 5-in. size). Take a sharp pair of shears and cut the halves of each bulb apart on the seam. Remove the threaded socket from the one half of each pair and solder a thin circle of copper over the hole.

The cross arms are made of $\frac{1}{4}$ -in. brass tubing 16 in. long, to which the cups are soldered. The rods are flattened in the center, and a $\frac{3}{16}$ -in. hole is drilled through both where they cross. This assembly is soldered to a $\frac{3}{16}$ -in. bushing, which will be used to clamp it on the upright shaft. A small cover should be soldered on to keep water out of the top bearing.

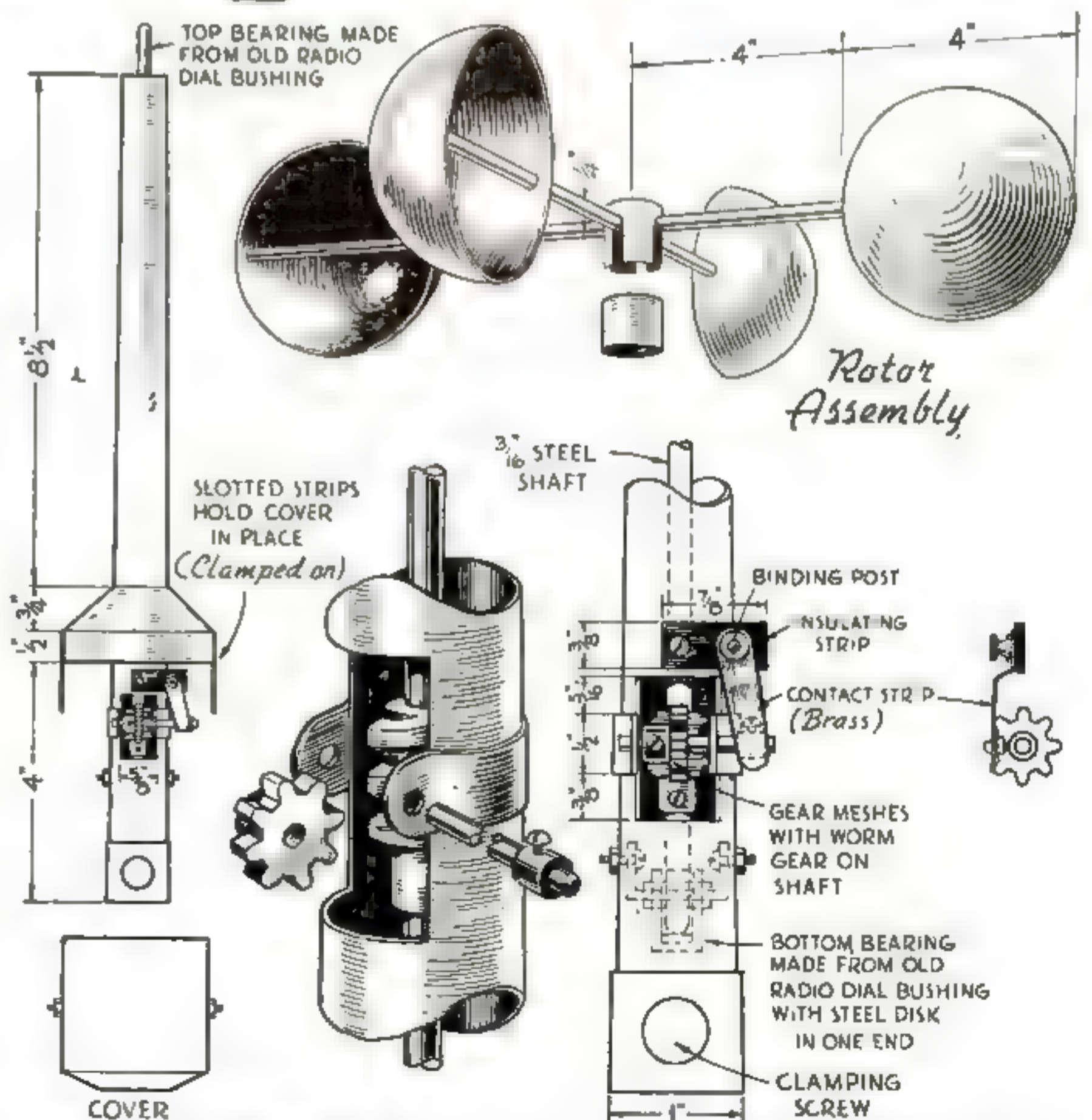
The body of the anemometer is made of galvanized iron or heavy sheet brass, or you can use a piece of brass tubing 1 in. in diameter and with walls about $\frac{1}{16}$ in. thick. The top bearing is a simple bushing in which the shaft revolves. It may be made of Babbitt metal poured around the shaft or from a regular brass bushing in which the shaft should fit rather loosely. The type of bearing used at the bottom is called a step bearing and consists of the inside bushing of a radio dial with a hard steel plate at the bottom. The end of the shaft is convex and rests on the steel disk. This bearing, which must be well oiled, gives almost frictionless support to the shaft.

The heart of the instrument is the gearing, and the gears must have a ratio of eight to one. A worm gear of the type found in *(Continued on page 110)*

Cheap copper tank floats are used as vanes, and the gears are taken from a toy construction set



At left is a close-up of the vanes, arms, and body of the instrument. Above is a view to show how it is connected in series with buzzer, doorbell transformer, and switch

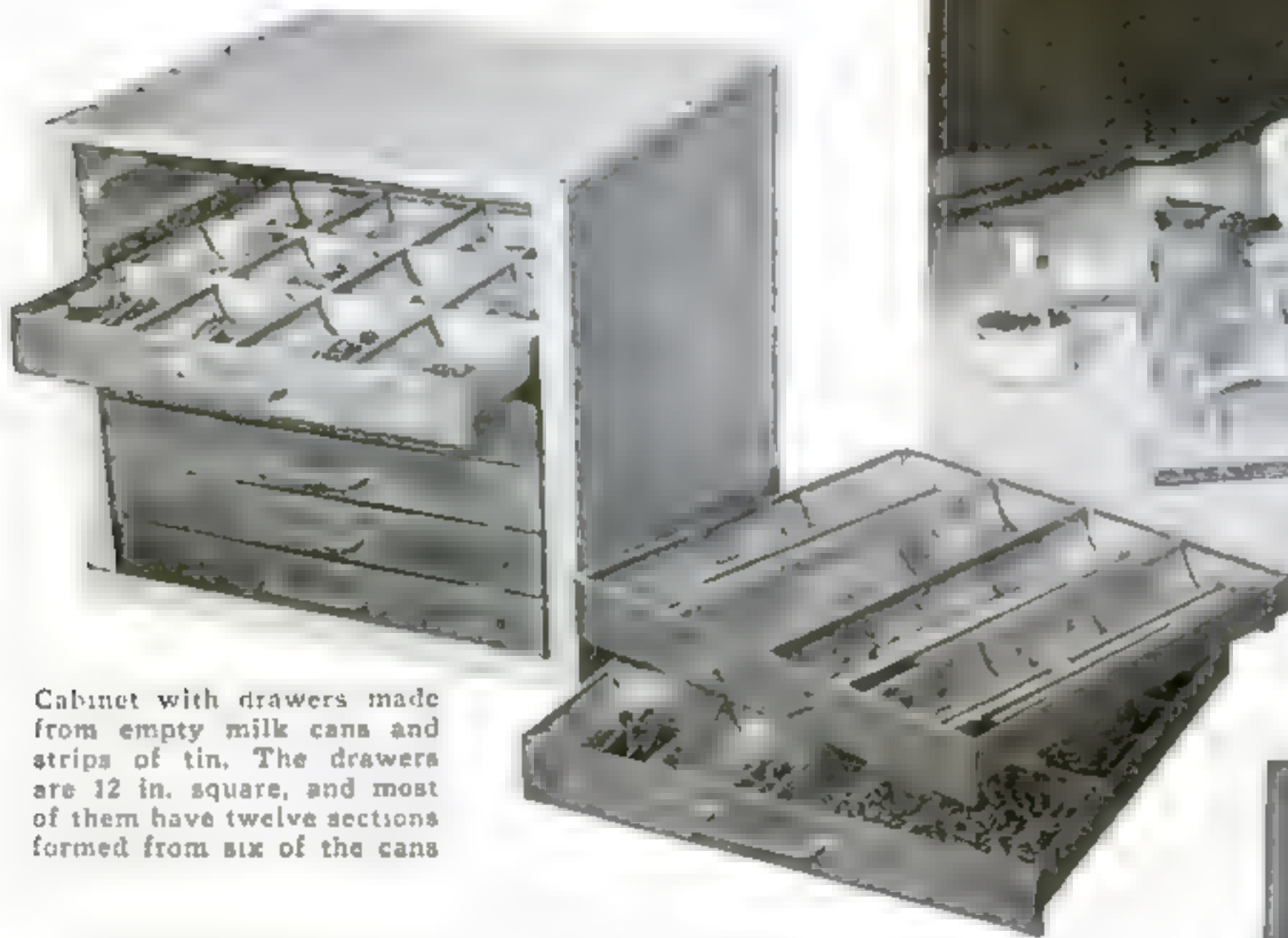


How rotor is assembled, gears and contact strip mounted, and the mechanism housed

Handy Hardware Drawers

ASSEMBLED
FROM MILK CANS

By Merle Terrill



Cabinet with drawers made from empty milk cans and strips of tin. The drawers are 12 in. square, and most of them have twelve sections formed from six of the cans

COMPACT, handy drawers with individual sections for sorting and storing bolts, screws, and other small parts can be made in a short time as illustrated from empty evaporated milk cans and a few strips of tin. Because of the rounded shape of these sections, pieces kept in them will slide to the center, where they can be picked up easily.

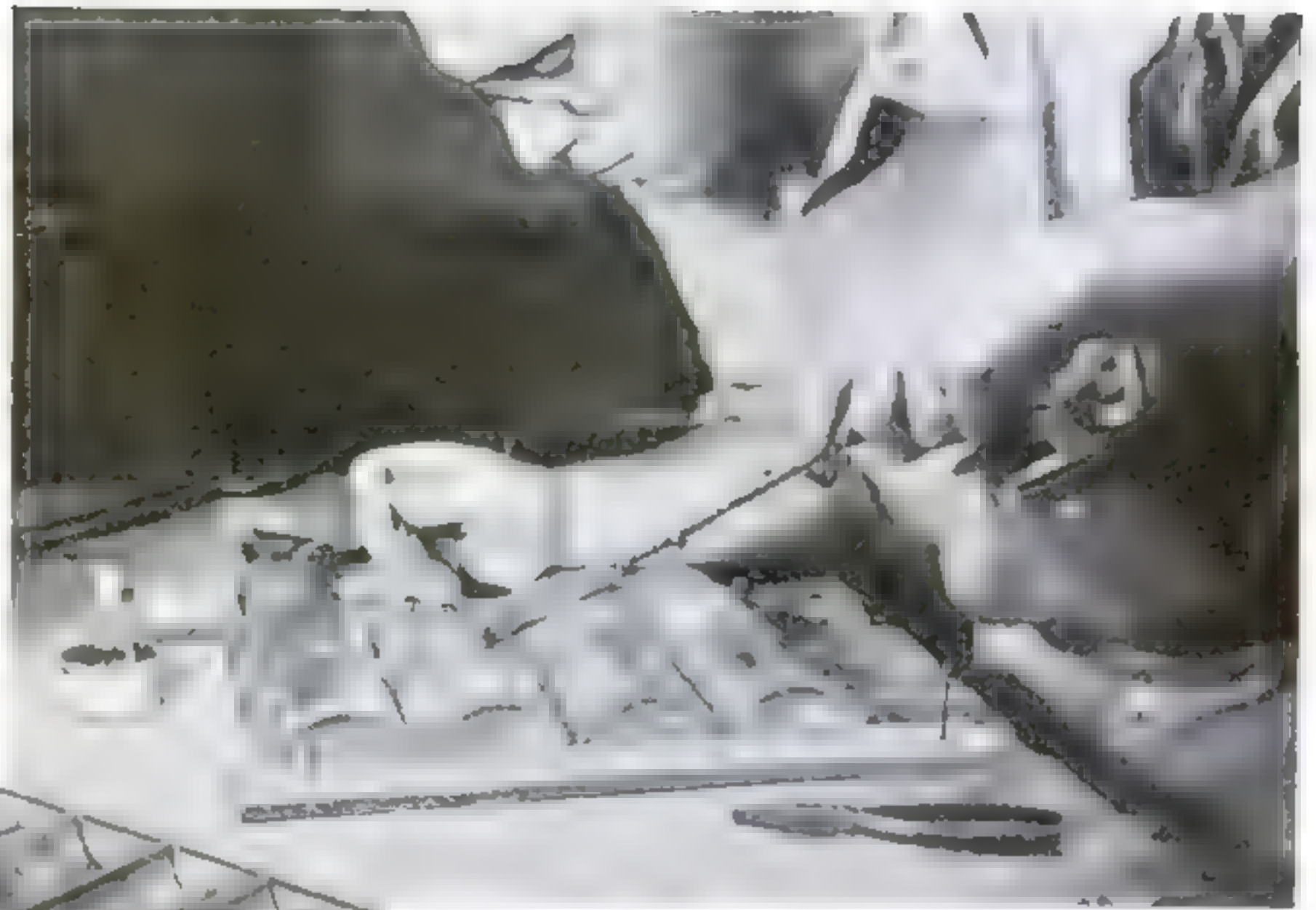
The cans are cut open across each end and down one side, and folded back on the remaining side to form twin compartments. They are then placed upside down on a bench or table as they are to be in the finished drawer, with a strip of tin between the ends of each row of cans, and soldered together and to the tin strips. The drawer thus formed is turned over, and the edges of the cans, where they form the partitions, are covered with bent strips of tin. The sides of the drawer are finished with wider strips of tin, which are bent over the cans and soldered as shown.

Note that the sides of the drawers are narrower than the front and back. This leaves a recess for the wooden runs on which the drawers slide.

For a handle, a piece of heavy wire is bent to shape and soldered into holes punched in the front of the drawer.

Drawers with longer compartments for rods, pieces of tubing, and the like can be made by removing both ends of the cans that form the inside sections, and one end of each of the outside cans. All are then soldered together. The sections are next formed into drawers by cutting slots about $\frac{1}{4}$ in. deep across the bottom of each row of cans, and soldering doubled strips of tin in the slots as shown at the right. These drawers are finished like those previously described.

The drawers can be made any size desired. Those illustrated are approximately 12 in. square, and most of them have twelve compartments (formed from six cans).

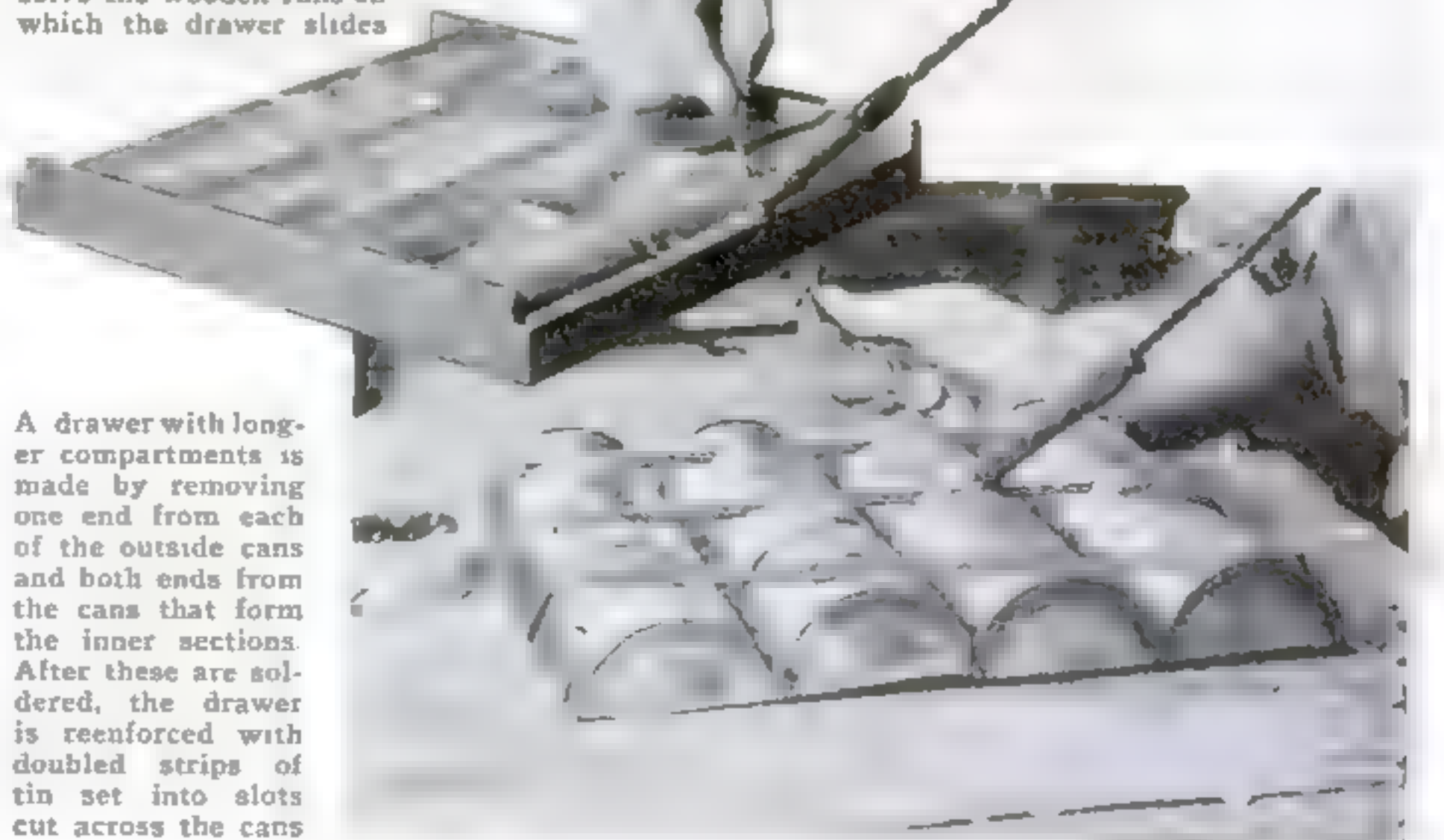


After the cans have been cut open across each end and down one side, they are folded to form twin compartments, arranged with tin strips between and soldered together

The drawer is now turned right side up, and the edges of the cans, where they come together and form partitions, are covered with bent strips of tin. The drawer shown contains six cans, which make up the twelve small, round-bottomed pockets



The outside edges of the drawer are completed as shown below with wider strips of tin, bent over the cans and soldered. The front and back are full width, but the sides are made narrower to receive the wooden runs on which the drawer slides



A drawer with longer compartments is made by removing one end from each of the outside cans and both ends from the cans that form the inner sections. After these are soldered, the drawer is reinforced with doubled strips of tin set into slots cut across the cans



"For Digestion's Sake Smoke Camels!"

**"MIGHTY GOOD ADVICE," SAYS THIS
HARD-RIDING TEXAS COW PUNCHER**

Copyright, 1936, R. J. Reynolds Tobacco Company, Winston-Salem, N. C.

"AFTER RIDING HERD from sun-up to sun-down, the chuck-wagon looks mighty good to me," says Fred McDaniel (*above, also right*). "But I wouldn't enjoy my 'chuck' half as much without the pleasure I get from smoking Camels with my meals and afterwards. After a good meal and Camels I feel plenty O.K. Camels set me right! And they never get on my nerves."



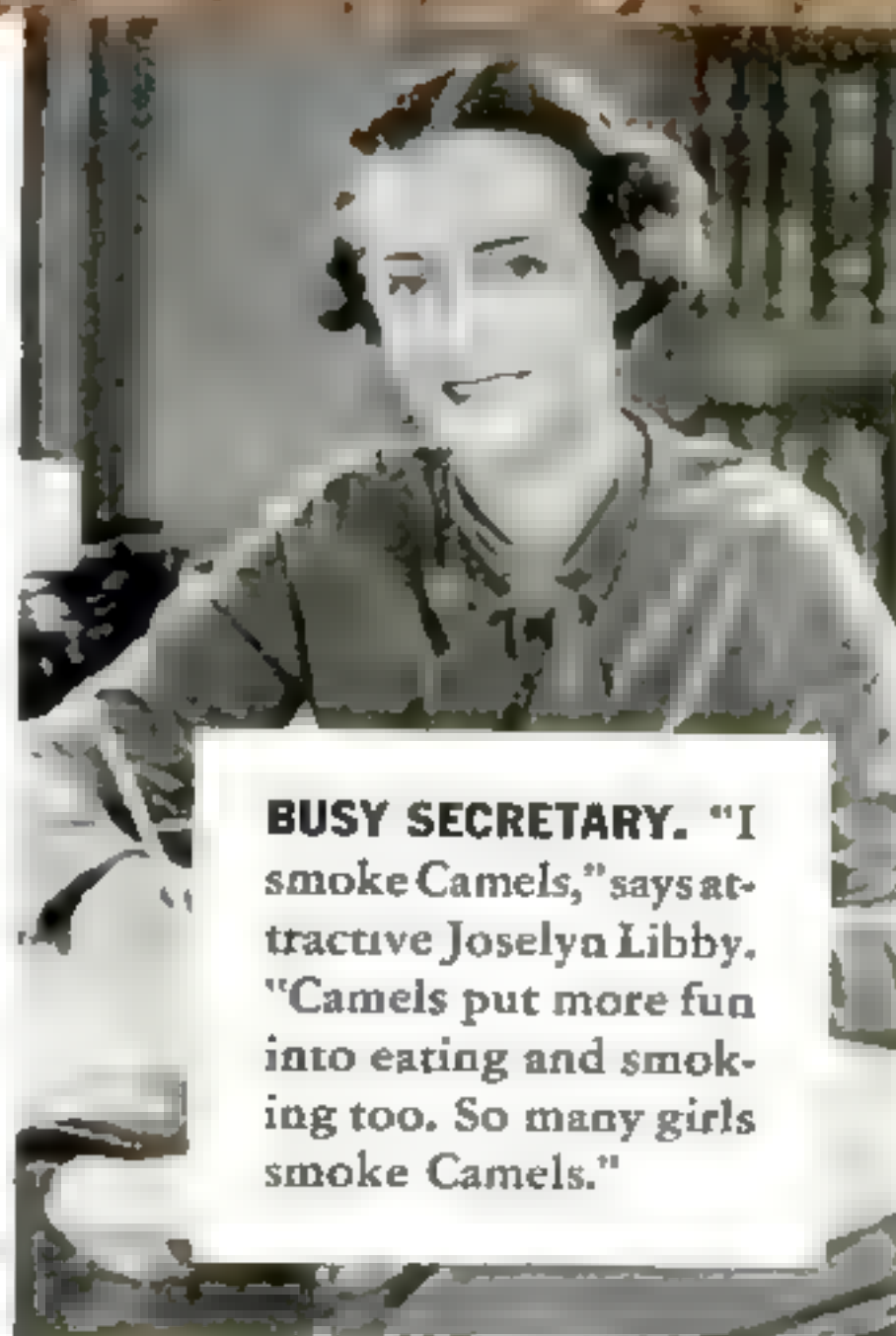
Smoking Camels, you enjoy a sense of ease while eating, and afterwards too!



WHAT Fred McDaniel says about Camels is backed up 100% by baseball's "Iron Man," Lou Gehrig — by Frank Buck, of "Bring 'Em Back Alive" fame — by Eleanor Tennant, outstanding woman tennis coach — and by millions of other Camel smokers in all walks of life. Enjoy Camels at every meal. They speed up the flow of digestive fluids. Increase alkalinity. Help you *enjoy* food. Camels set you right!

COSTLIER TOBACCOS

CAMELS ARE MADE FROM FINER, MORE EXPENSIVE TOBACCOS
...TURKISH AND DOMESTIC...THAN ANY OTHER POPULAR BRAND



BUSY SECRETARY. "I smoke Camels," says attractive Joselyn Libby. "Camels put more fun into eating and smoking too. So many girls smoke Camels."

EASILY MADE Photo Printing Box

Reduces Darkroom Drudgery



This efficient printer for photographs makes use of a standard automasking printing frame, so the construction work is relatively simple

By M. S. BURLEIGH

IF YOU were to figure up the time spent in fastening and unfastening the platen of your photo printing frame and moving the whole into position to make the exposure, you would find that the wasted minutes amounted to a large percentage of the time spent in the darkroom. With a printing box like the one illustrated, you could have the print in the developer by the time you are ready to make the exposure with an ordinary printing frame.

This printer has been tested with a high-grade electric exposure meter and found to give even illumination over the entire surface of the printing frame. It is very fast, the exposures ranging from two to ten seconds.

The necessary parts are few. Some of them you may have on hand; the remainder can be bought from regular dealers without difficulty. The box shown cost less than three dollars for materials, yet it contains all the refinements of the average factory-built amateur printer.

The box itself may be constructed of $\frac{1}{4}$ -in. three-ply wood, or a wooden box from your grocery store may be used. The over-all dimensions are roughly $10\frac{1}{2}$ by $14\frac{1}{2}$ by 11 in. high. An additional feature is a drawer for the safe storing of exposed or unexposed printing paper. The drawer is approximately $10\frac{1}{4}$ by $12\frac{1}{2}$ by 1 in. All dimensions, of course, may be altered to suit your needs.

A regular printing frame or an auto-



How the switches, lamps, and reflector are arranged. There should be a separation of $\frac{1}{2}$ in. between the red and white lights

When the lever is pressed down, it closes the frame and turns on the white lamps, making the exposure

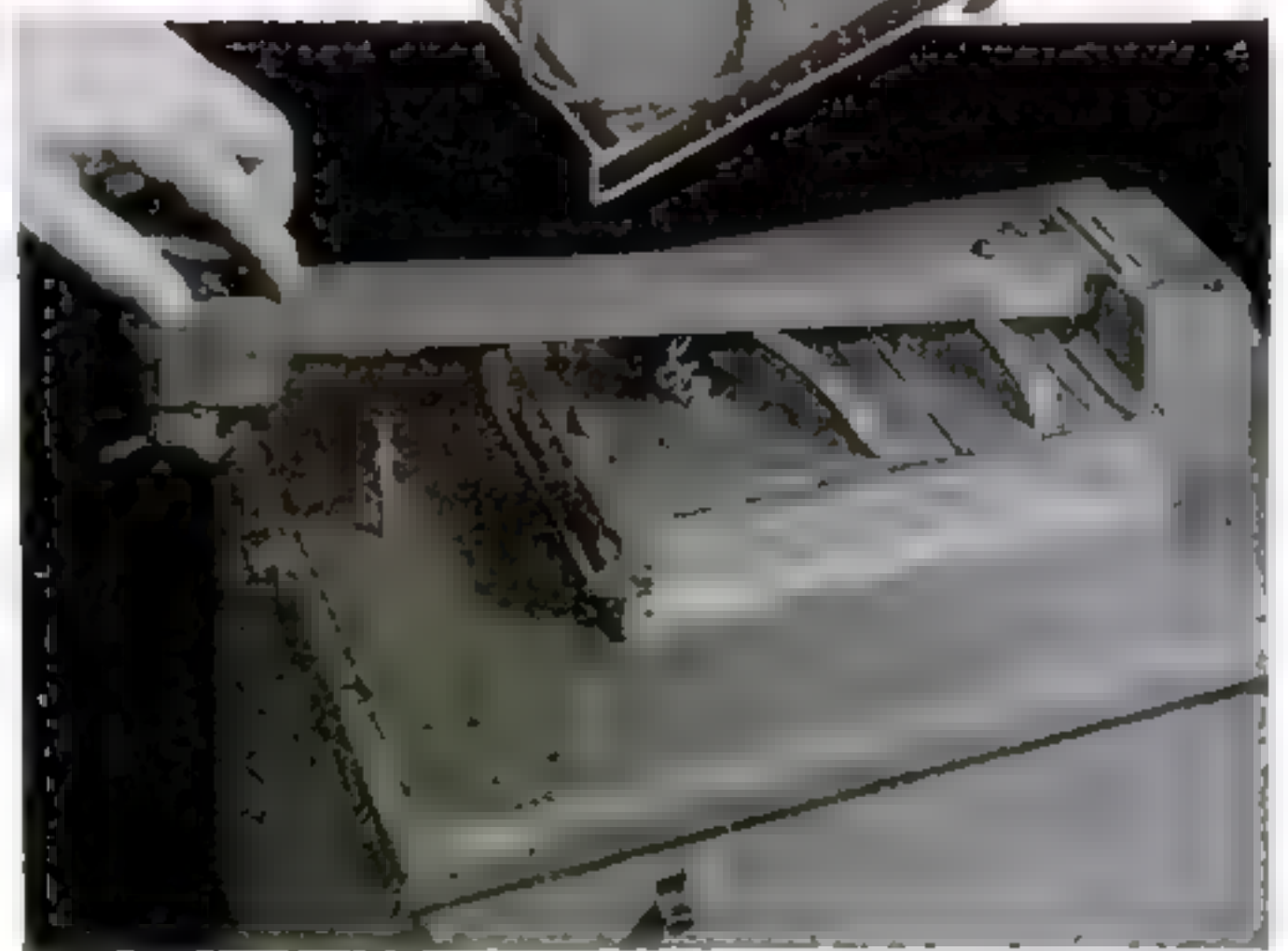
masking frame may be used, but the time saved by the automasking type makes it worth the additional expense. In this case, a 5 by 7-in. frame was used. Make another plain frame of $\frac{1}{2}$ -in. strips and glue or nail it to the underside of the printing frame so as to block the latter up high enough to enable the masking arms to be adjusted easily.

Remove the two springs from the platen (pressure board) by drilling with a $\frac{1}{8}$ -in. drill, and hinge the platen to the frame as shown. Then cut a hole in the center of the box (in this case, 5 by 7 in.), and glue or nail the altered frame in place.

Cut a block of wood from 2-in. thick

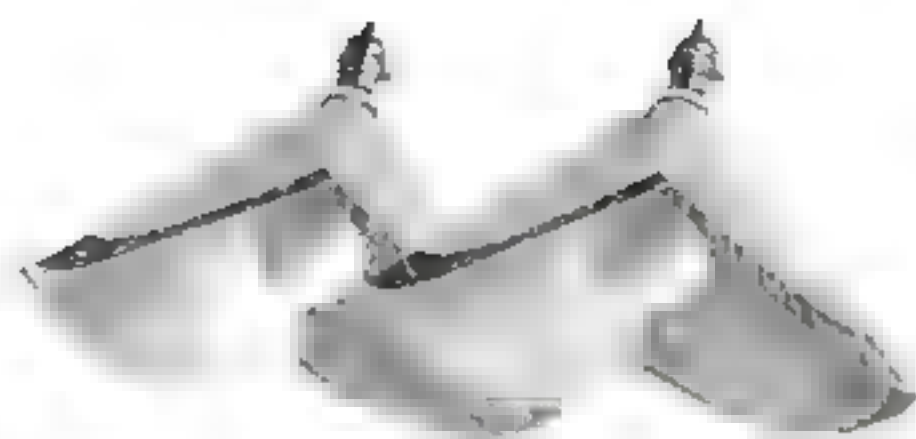
stock, making it 3 in. wide at the top, 4 in. at the base, and 2 in. high. If plywood is used for the top of the box, it should be reinforced underneath with 1-in. stock, because a great deal of strain comes at this point. Fasten the block where indicated with three or four long wood screws driven up from below.

Next hinge the lever arm, which is cut from 1-in. stock 15 in. long, to the block, and fasten the springs with $\frac{1}{8}$ -in. stove bolts to the arm opposite to their former positions on the platen. Hold the lever arm in a horizontal position to determine the proper place for setting an elbow catch and hook. *(Continued on page 108)*





Load your camera
with Kodak "SS" Film



Use two or three
Photoflood Lamps
and Reflectors

1

All you do

2

to make snapshots at NIGHT



HERE'S good news for every camera fan who's keen to get snapshots at night, but hasn't had a fast enough lens.

Now, even a simple Brownie makes snapshots (instantaneous pictures) indoors after dark.

Just use Kodak "SS" Film, and two or three of the new No. 2 Mazda Photoflood lamps, which last for hours, and Model B Kodak Handy Reflectors.

If your camera has an $f.6.3$ or faster lens, No. 1 Photoflood lamps are powerful enough.

FREE BOOKLET...

Contains all you need to know about *both* kinds of night pictures—*snapshots* with Photoflood lamps, *fast exposures* with Photoflash lamps. (You can use Photoflash lamps, each good for one picture, if your camera can be set for "time.") The booklet's helpful pictures and diagrams show you how to arrange your lights . . . how to place your subject . . . and it even suggests a variety of picture opportunities. Get a copy at your dealer's . . . Eastman Kodak Company, Rochester, N. Y.



THE MONTH'S BEST Auto Ideas

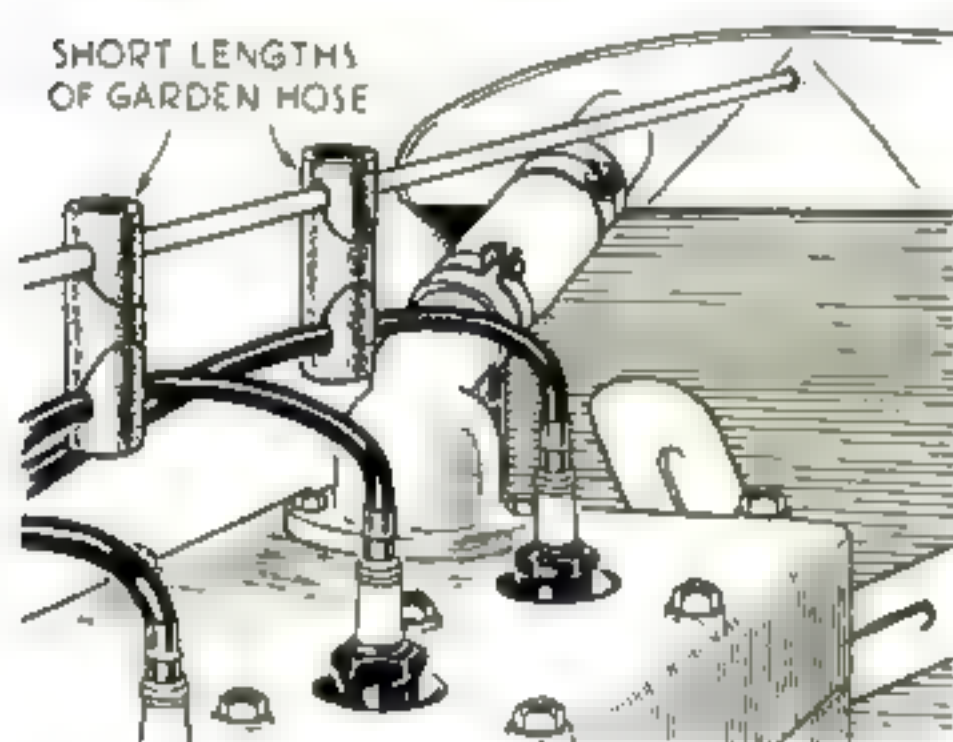
*Time-Saving Suggestions
For Car Owners Made by
Our Experienced Readers*

WHEN an ice-filled lock makes it impossible for you to open the doors on your car, try the simple hook-up shown in the illustration at the left. Borrow a storage battery and several pieces of heavy wire from your neighborhood garage. Attach one wire to the key and insert it in the lock, and ground the other wire to some metal part. Then, after making certain of good connections, momentarily touch the other ends of the wires to the battery terminals. The short circuit will generate enough heat in the key to melt the ice and allow the lock to be turned. If no auxiliary battery is available, current can be tapped from the unit in the car by connecting the key wire to the battery-circuit terminal on the starter motor.—J. C.



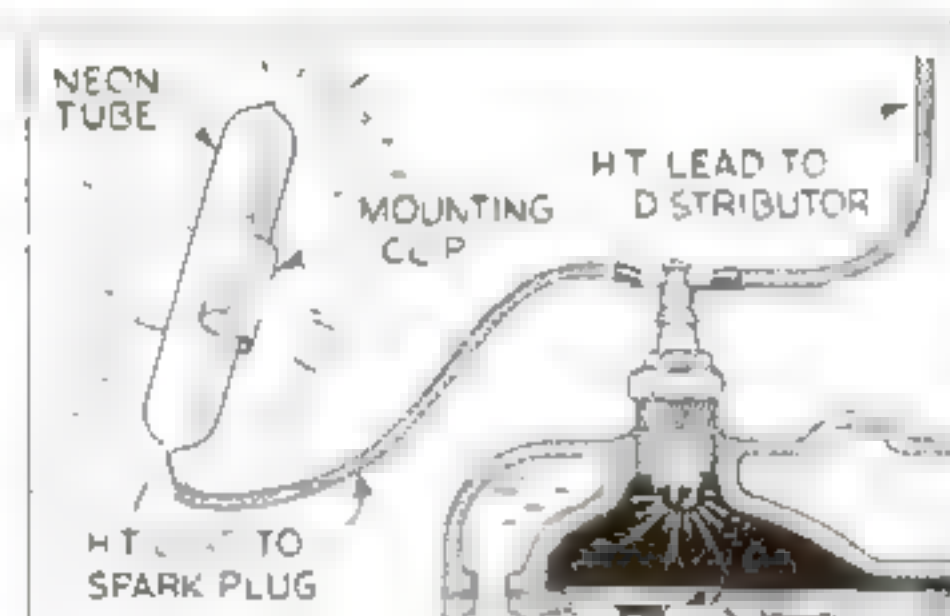
How a storage battery wired to a key can be used to thaw the ice in a car-door lock

Ignition-Wire Clips Made from Garden Hose



The clips hold the wires up out of the way

HANDY clips for holding spark-plug wires up out of the way can be made from three-inch sections cut from an old garden hose. As shown at the left, they are provided with two pairs of slits and holes—one to fit over the radiator brace rod, the other over the wire. If the holes are made smaller than the diameters of the spark-plug wires and rod, the slits will provide enough tension to grip the parts firmly and prevent slipping. Being made of rubber, the clips are nonconducting, will not rattle, and can be slipped on or off quickly. If you wet your knife, it will be easy to cut the rubber.—A. H. B.

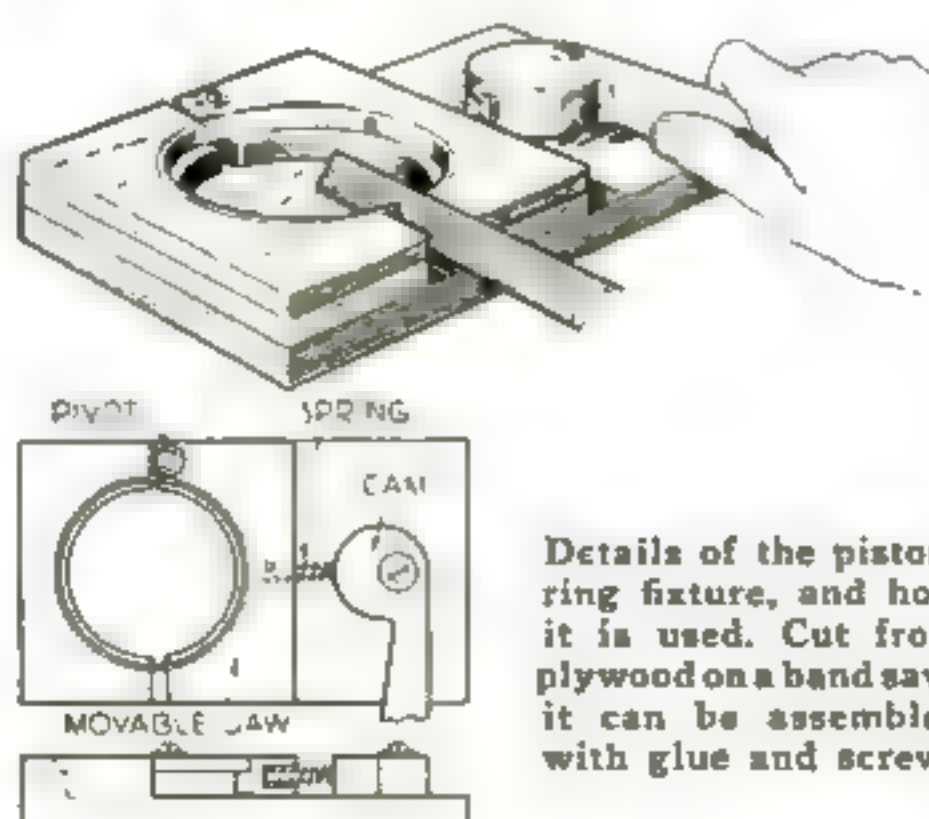


Dashboard Indicator Reveals Stalled Motor

A **NOVEL** dashboard indicator that will show at a glance whether or not your motor has stalled during a traffic stop can be made from an ordinary spark-plug tester. Obtain a pencil-type tester and remove the tiny neon tube from its center. Mount the bulb behind a small window cut in the dashboard and connect its single wire to one of the spark plugs, insulating it carefully. Each time that particular plug fires, the neon tube will flash. Besides serving as an engine indicator, the "flasher" also can be used as a revolution counter.—C. V.

Holes In Battery Cover Simplify Recharging

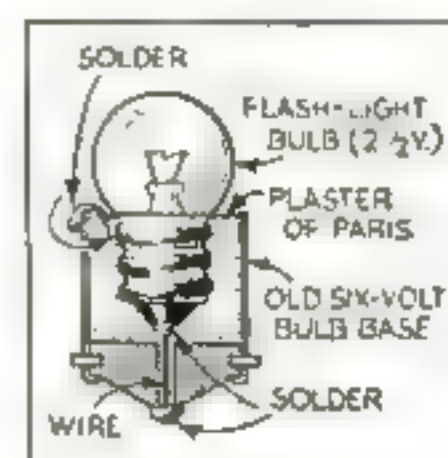
IF YOUR car is equipped with heater, windshield defroster, and radio, and you find it necessary to charge the battery periodically, you will find that connection holes cut in the battery-box cover will save time. The charger then can be placed nearby on the floor and the battery charged without removing it from the car. Use large rubber stoppers to cover the holes.—R. T.



Details of the piston-ring fixture, and how it is used. Cut from plywood on a hand saw, it can be assembled with glue and screws

Jig Holds Piston Rings for Accurate Filing

MUCH of my success in installing new piston rings in my car, I lay to a simple fixture that I designed to hold the rings while the ends were filed. It consists of two semicircular jaws, a base, and a cam lever. When a ring is placed in the jig, the file is inserted between the ends and the cam turned until just the right spring tension is provided. By trial, the tension can be adjusted to correspond with the amount of metal to be removed by the filing operation.—E. C. H.



Small Bulbs Save Battery

BY MAKING a slight alteration in your car's wiring, you can use your parking lights for long periods without putting too much of a drain on your battery. The change consists of installing an auxiliary tail light and fitting it as well as your parking lights with two and one-half-volt flash-light bulbs instead of the usual six-volt lamps. Simply provide the bulbs with standard bayonet bases, as shown, and place a 150-ohm resistance in the parking-light circuit to reduce the battery voltage.—P. R. T.



Small storage-battery charger in use in car

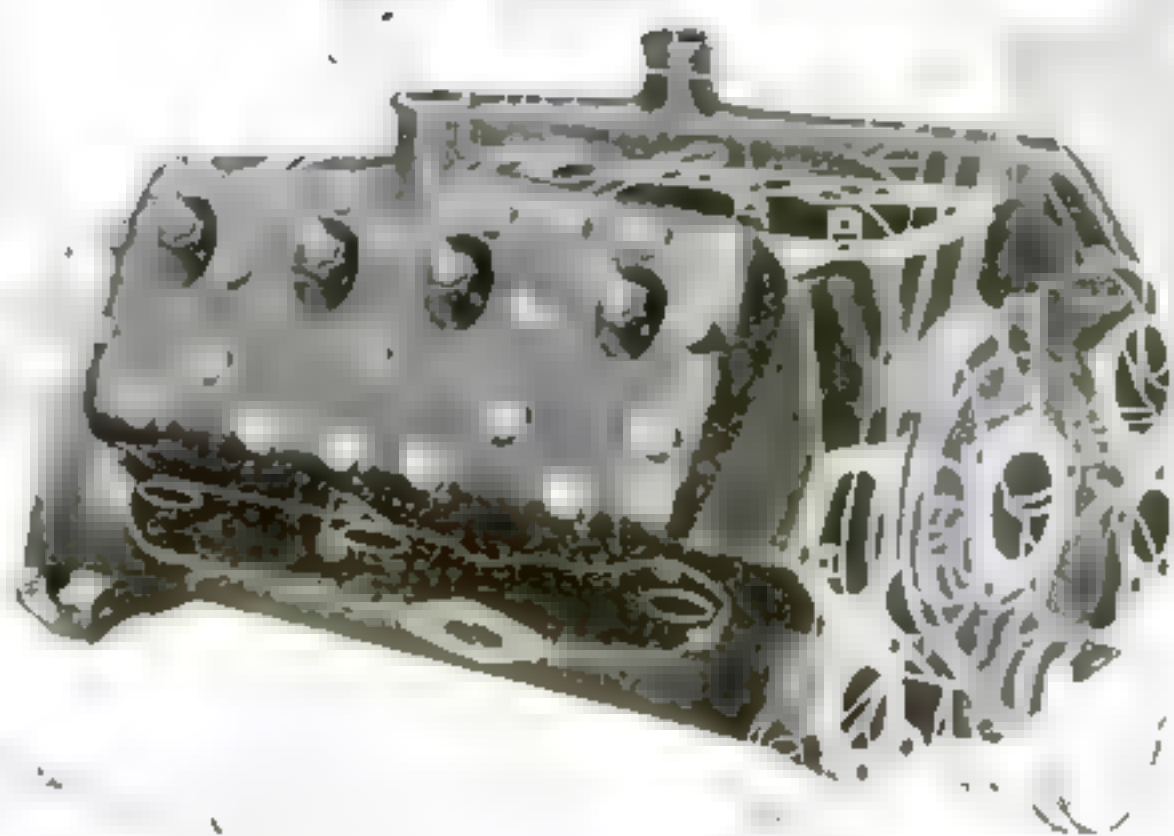
FORD OWNERS ALONE ENJOY THIS MONEY-SAVING FEATURE

Engine and Parts Exchange Plan

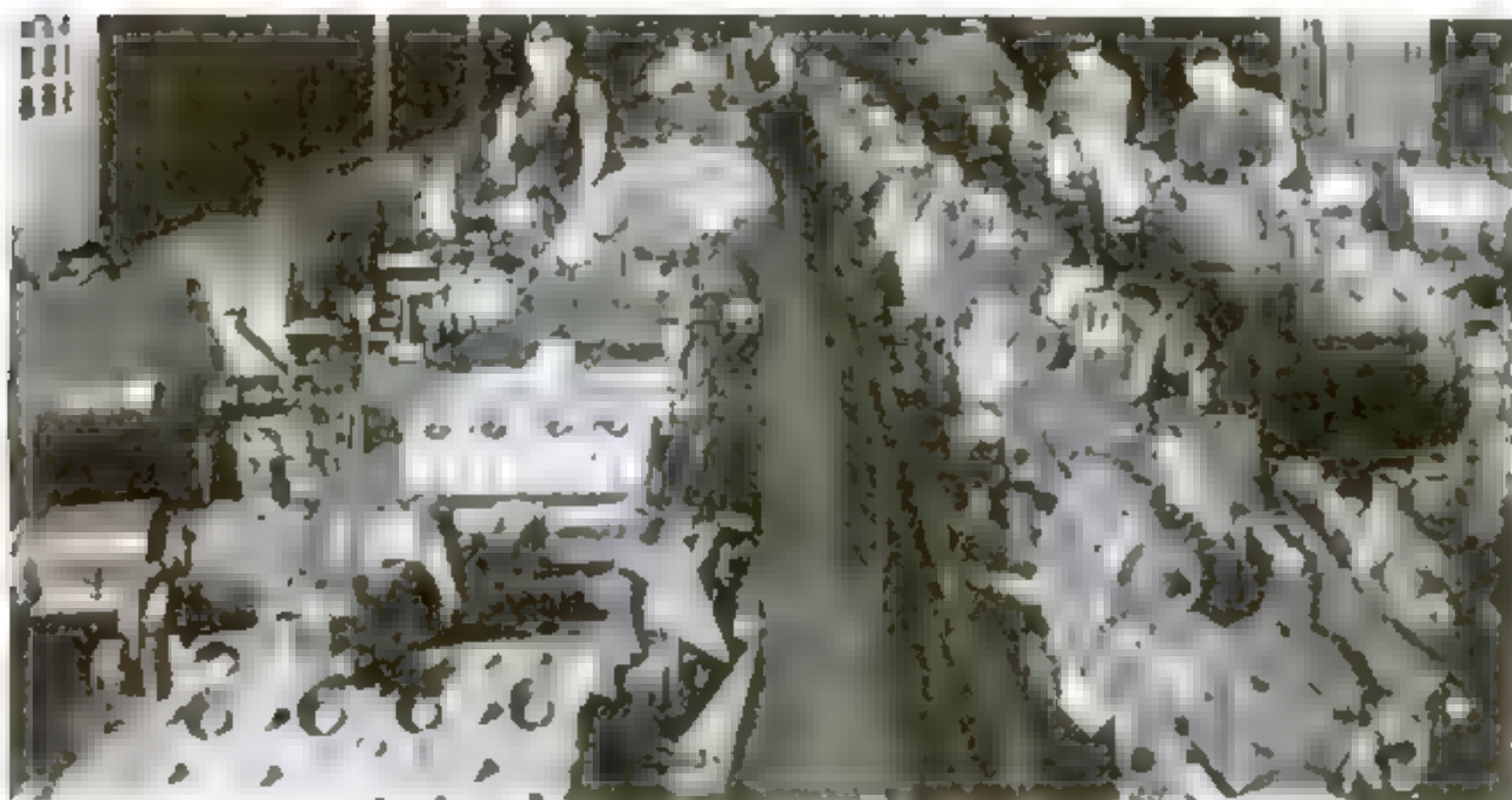
You may never need to have your Ford V-8 engine overhauled. But if you should, after many thousands of miles, you'll appreciate the time and money saving advantages of the Ford Engine and Parts Exchange Plan.

Through this plan you can exchange your Ford engine for a factory-reconditioned engine at a big saving over the cost of an engine overhaul. A complete engine overhaul usually costs well over \$85. A Ford factory-reconditioned engine may be installed for \$56 (slightly more west of the Rocky Mountains). This includes reboring of the cylinders, new pistons, piston pins, piston rings, bearings and valve springs. Crankshaft, camshaft, valve lifters, valves, retainers, timing gears and oil pump are either rebuilt or replaced with new ones as needed.

Many other reconditioned Ford parts, too, are available at remarkable savings



Phantom view of Ford V-8 engine, showing parts included in Engine Exchange Plan in solid black.



(Above) Reconditioned engines are block-tested and given the same rigid inspections as new engines.

to Ford owners — savings made possible by Ford mass production methods. In the case of all Ford reconditioned engines and parts, experienced workmanship, quality materials, precision manufacturing methods, rigid tests and inspections are the same as in the building of new Ford engines and parts.

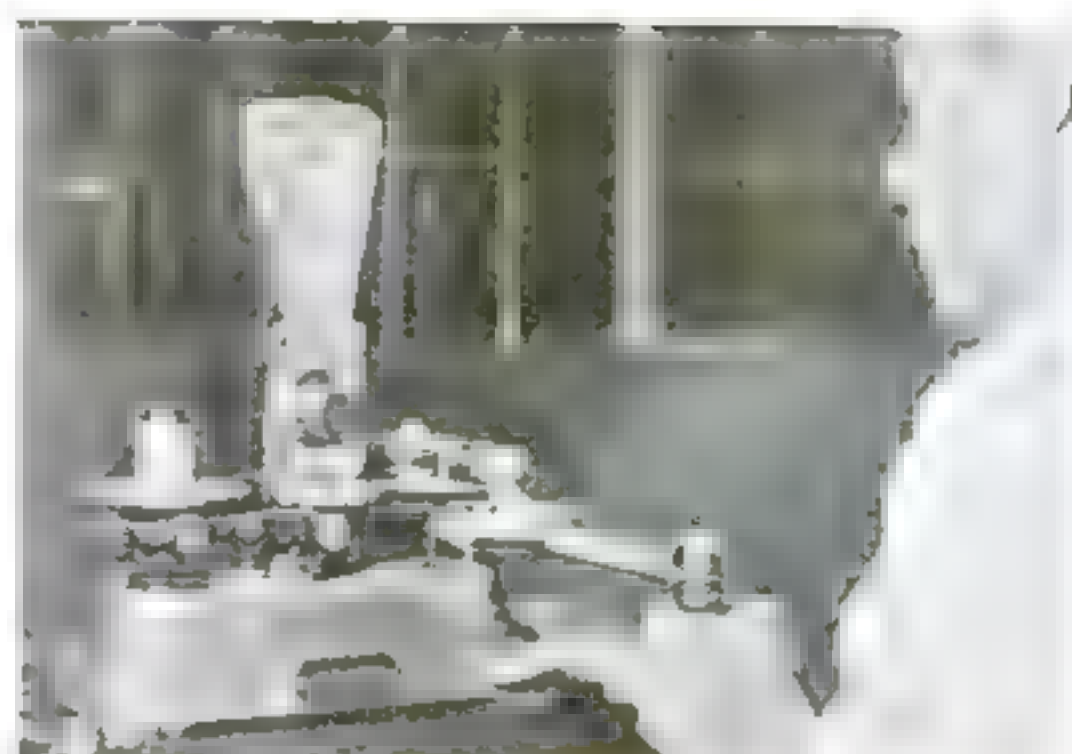
Ask any Ford dealer or any garageman who displays the sign, "Genuine Ford Parts," to give you complete details of the Ford Engine and Parts Exchange Plan.

FORD MOTOR COMPANY
DEARBORN MICHIGAN



All reconditioned parts are subjected to final tests to make sure that performance is up to standard and that all adjustments have been correctly made. Photo at left shows a reconditioned distributor receiving final test.

Parts used in reconditioning the engine are tested and inspected with the same care as parts used in new engines. Photo at right shows inspector checking weight of connecting rods on sensitive balance.



REPAIRS FURNITURE



Makes 1001 Household Repairs

Damaged Furniture	Loose Bathroom Fixtures
Loose Drawer Pulls	Drainboard Cracks
Loose Casters	Holes Around Pipes
Old Nail and Screw Holes	Countersunk Screws
Repairing Screens	Repairing Linoleum
Replacing Wood Rot	Reset Loose Handles
Patching Auto Tops	Loose Tiles
Baseboard Cracks	Pattern Making
Floor Cracks	Cracked Porcelain
Modeling:—Amateur—Professional	

Genuine Plastic Wood makes household repairs so easily yet permanently — this wood in putty form dries to hard wood — when dry it can be sanded, sawed, carved; will hold nails and screws perfectly without chipping or cracking. Genuine Plastic Wood is waterproof and weather-proof and will adhere to any clean, dry surface—wood, metal, stone, glass or porcelain.

Anyone Can Use Plastic Wood

Genuine Plastic Wood is easy to use — comes in nine different colors to match any object repaired. Its soft putty form makes it easy to make repairs. Children even use Genuine Plastic Wood to model life-like objects. Keep it handy. Sold at all paint and hardware stores. In cans and tubes.



BLUEPRINTS

TO AID IN Your Shopwork

OUR special blueprint list becomes longer each month because we are constantly adding new, up-to-the-minute plans. If you have not obtained a recent list, send a stamped, self-addressed envelope for one immediately. Study it carefully and you will be surprised to find the large number of useful, valuable, and instructive projects that are available. Prepared and tested by experts, our plans will help assure the success of your home workshop.

A partial list of blueprints is given below. In most cases the blueprints are printed on 15 by 22-in. sheets. When ordering, it is necessary to give only the blueprint numbers. Where two or more numbers follow a single title, it means that there are two or more blueprints in the complete set. The letter "R" indicates that a supplementary bulletin of instructions is included in the set.



MODELS

Barbary Pirate Galley or Felucca, 44-45-R	.75
Barnegat Lighthouse, 298A	.25
Bluenose, Famous Fishing Schooner (17½-in. hull), 110-111-112-R	1.00
Clipper Ship Sovereign of the Seas (20½-in. hull), 51-52-53-R	1.00
Clipper Ship in a Bottle, 121-122	.50
Coast Guard Patrol Boat (20½-in.), 286-287-R	.75
Constitution (21-in. hull), 57-58-59-R	1.00
Cruiser U.S.S. Indianapolis (12-in.), 216	.25
Farragut's Flagship Hartford (33½-in. hull), 221-222-R	1.50
Freighter, Ocean (14-in.), 271	.25
Galleon Revenge (25-in.), 206-207-208-209	1.00
Gettysburg Cannon (11½-in.), 292A, 293A	.75
Hispaniola (7-in.), 297	.25
H. M. S. Bounty (8½-in. hull), 254	.25
Liner—Manhattan (12-in.), 204	.25
Liner—Normandie (20½-in.), 264-265	.50
Liner—Queen Mary (10½-in.), 283	.25
Nourmahal, power yacht (8½-in.), 276	.25
Oil Tanker (14-in.), 294	.25
Privateer of 1812—Swallow, a Baltimore clipper (13-in. hull), 228-229-230-R	1.00
Racing Yacht Seascout (42-in.), 106-107-R	.75
Roman Galley (19-in.), 138-139-R	.75
Seaplane, Tractor Model (30-in. wing spread), 87	.25
Sea Witch, Clipper Ship (9½-in. hull), 219	.25
Show Boat (14-in.), 263	.25
Spanish Treasure Galleon (24-in.), 46-47	.50
Tugboat, Harbor (11½-in.), 284	.25
Tugboat, Water-Line (5 3/16-in.) and Barge (7 3/16-in.), 285	.25
U. S. Destroyer Preston (31½-in.), 125-126-127-R	1.00
Viking Ship (20½-in.), 61-62-R	.75
Whaler—Wanderer (20½-in.), 151 to 154	1.00
Winnie Mae, 4-ft. Flying Scale Model, 141-142-143	.75
Yacht Rainbow (7½-in. hull), 233	.25

{ Construction kits are available for some of these models. See page 22. }



FURNITURE

Bed, Double-Decker, 277A	.25
Cabinet, Smoking, 2	.25
Coffee Table, 245A	.25
Colonial Writing Desk, 21	.25
End Table, American Empire, 241A	.25
Floor Lamp with Tripod Base, 243A	.25
Folding Screens, Four Modernistic, 91	.25



Gate-Leg Table with Round Top, 24	.25
Modernistic Book Ends, Low Stand, and Bookshelf, 100	.25
Mosaic Serving Tray, 297A	.25
Pier Cabinet, 77	.25
Queen Anne Dressing Table, Stool, and Mirror, 295A	.75
Reading Tables, Two, 68	.25
Scroll Mirror and Tavern Table, 105	.25
Sewing Cabinets, Priscilla and Modern, 31	.25
Smoking Stand, Modern, 238A	.25
Stool, Upholstered, 240A	.25
Table, Four-Leaf Card, 239A	.25
Tilt-Top Table (turning), 140	.25
Treasure Chests (metal bindings), 78	.25
Wastebasket and Magazine Rack, 296A	.25



MISCELLANEOUS and TOYS

Automatic Lighthouse Night Lamp and Sewing Kit, 255A	.25
Colonial Doll's House, 72	.25
Dog-and-Woodchuck Book Ends, 297A	.25
Doll's House Furniture, 73	.25
Outdoorsman's Lightweight Trailer (10-ft. long, 4 ft. wide, 4 ft. 9 in. high; kitchenette on back), 300-301	.50
Perpetual Star Chart, 214	.25
Projector for Photos and Pictures, 259A	.25
Simple Jewelry Designs, 298A	.25
Sundial, Metal, with Concrete Pedestal, 291A	.25
Toy Birds and Animals, Jig-Sawed, 56	.25
Toy Drill Press, Lathe, Saw, etc., 113	.25
Toy Fire Engine, Dump Truck, etc., 101	.25



RADIO SETS

All-Wave Portable Receiver (two tubes, operated by battery), 217-R	.50
Amateur Short Wave Receiver, 155	.25
Amateur Radio Transmitter, 183-184	.50
Five-Tube Short Wave (A.C. or D.C.), 223	.25
Full Electric Headphone Set, 130	.25
One Tube (battery operated), 103	.25
Screen-Grid Set, 109	.25
Short-Wave Converter Unit, 137	.25



BOATS

Canoe, 16-ft., Canvas-Covered Kayak, with sail, etc., 192-193-194-R	1.00
Combination Boat, 15-ft., for sail, outboard motor, or oars, 131-132-133-R	1.00
High-Speed Boat for Small Outboard Motors (7 ft. 11 in. long), 257	.25
Ice Scooter (has hull like boat), 161A	.50
13-ft. Motorboat-Rowboat (has decked hull; for use with outboard or inboard drives and oars), 147-R	.50
Runabout Sportboat (15½ ft. long with detachable top, seats that fold into bunks, etc.; for use with outboard or inboard drives), 175-176-177-R	1.00
Utility Rowboat, 13-ft., (can also be sailed or driven by outboard motor), 224-R	.50

Popular Science Monthly
353 Fourth Avenue, New York

Send me the blueprint, or blueprints, numbered as follows

I am enclosingdollars cents

Name.....

Street.....

City and State.....

Please print your name and address clearly.



Old
Bill

SAYS:

WHEN using a tool-post grinder in the lathe to grind diameters to close tolerances, swivel the compound rest 80 deg. from center. Each movement of 0.001 in. on the micrometer dial will then move the grinding wheel forward 0.00017 in. The advantage of this method of taking minute cuts of known value is readily apparent.

Counterbore pilots should be made from machine steel and casehardened to insure a hard surface at point of contact and a tough core to withstand torsional strains.

The amateur tool hardener will find that the determination of the correct quenching point of steel requires keen judgment. For that reason he should accustom himself to using green or blue glasses for observation purposes when determining temperatures by color. The naked eye isn't good enough as it adjusts itself to extreme conditions of contrast.

When tapped holes are incorporated in enameled metal parts, tap the holes after enameling, not before. Retapping holes to remove paint is an unnecessary task.

Most frictional losses in spring motor actuated mechanisms such as moving-picture cameras and phonographs occur in the gearing. For that reason, when such mechanisms fail to operate or appear sluggish, clean the gear teeth with a tooth brush and benzine and lubricate with ordinary cup grease to which a suitable amount of powdered soapstone has been added.

Where developed dimensions of pieces of sheet metal of large area must be determined for bending or forming operations, experiment with narrow strips of identical material of the same gauge.

One way to find the correct size-tap drill is to divide 0.975 by the number of threads per inch, and subtract the quotient from the outside diameter of the tap. If you are tapping thin sections, a full thread is necessary, and in this case the constant 1.299 should be used instead of 0.975.

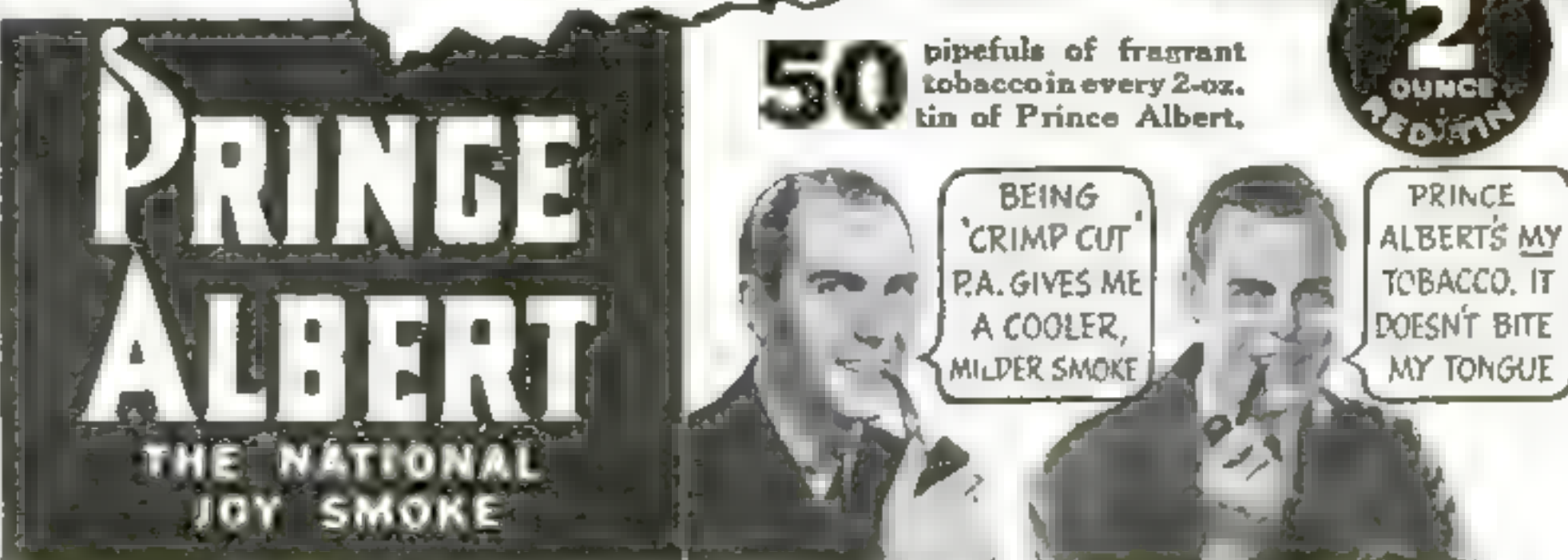
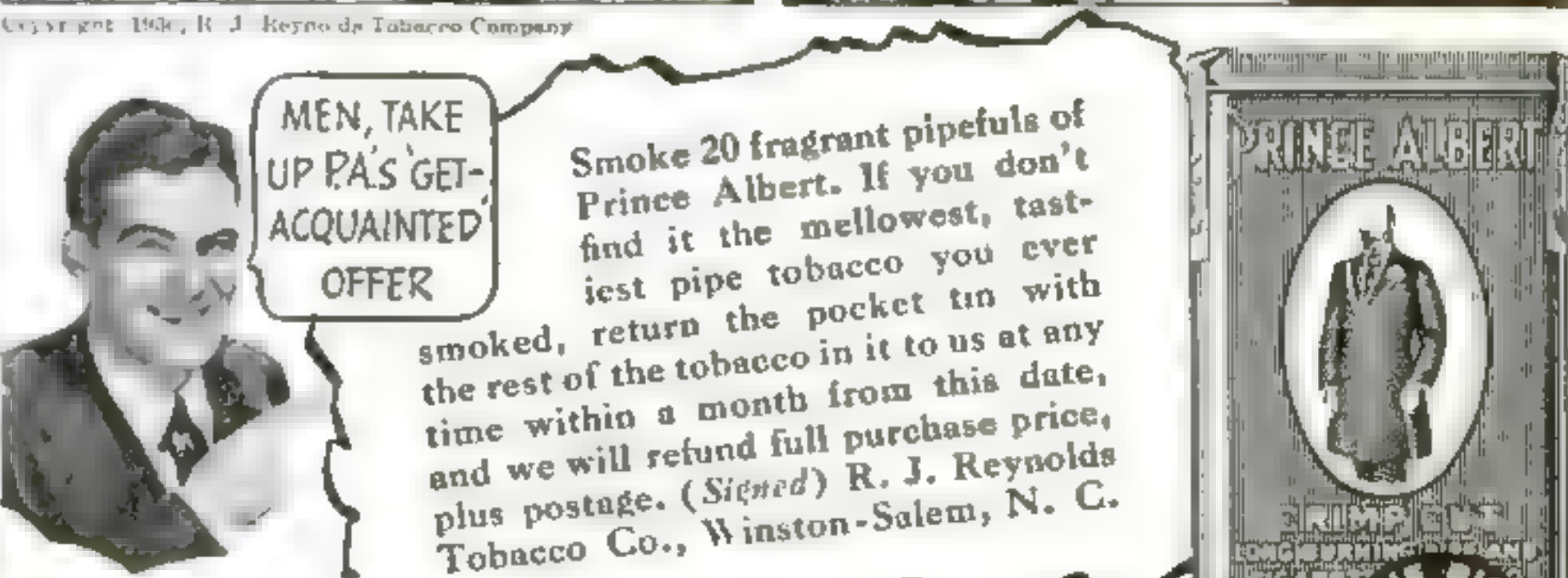
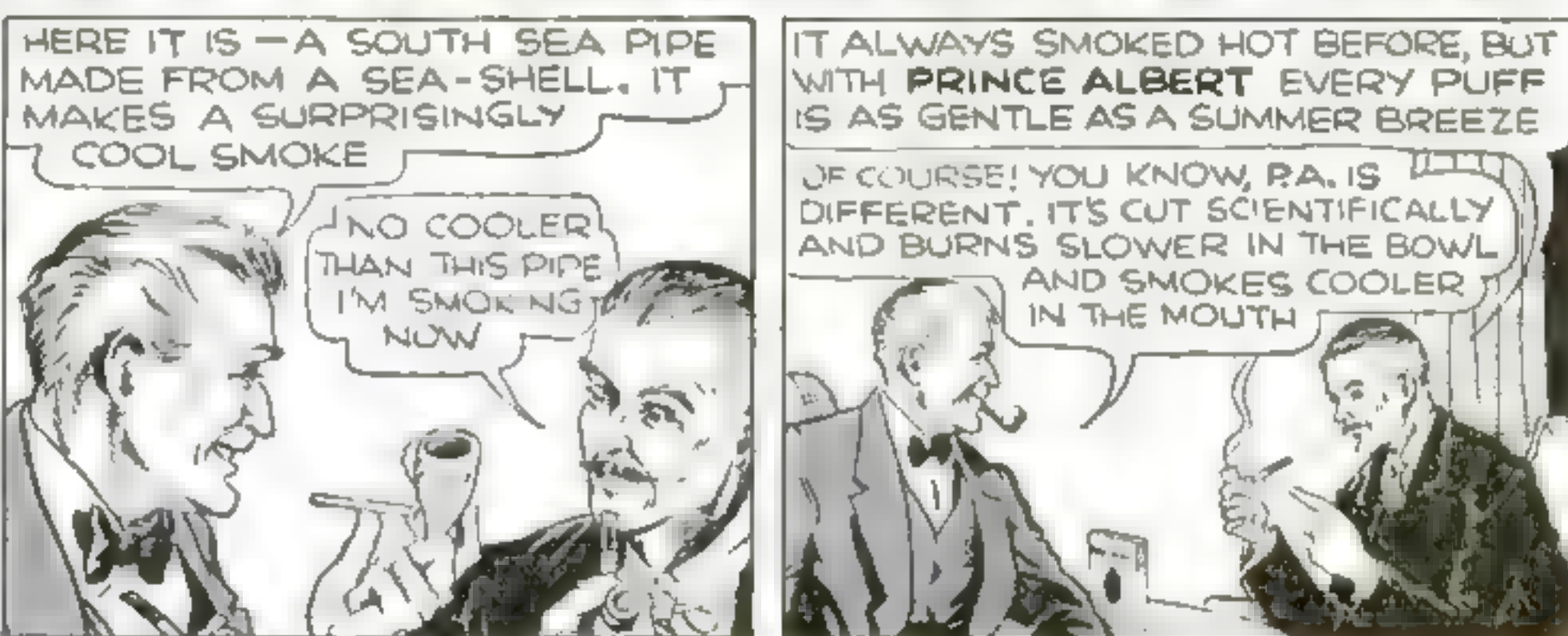
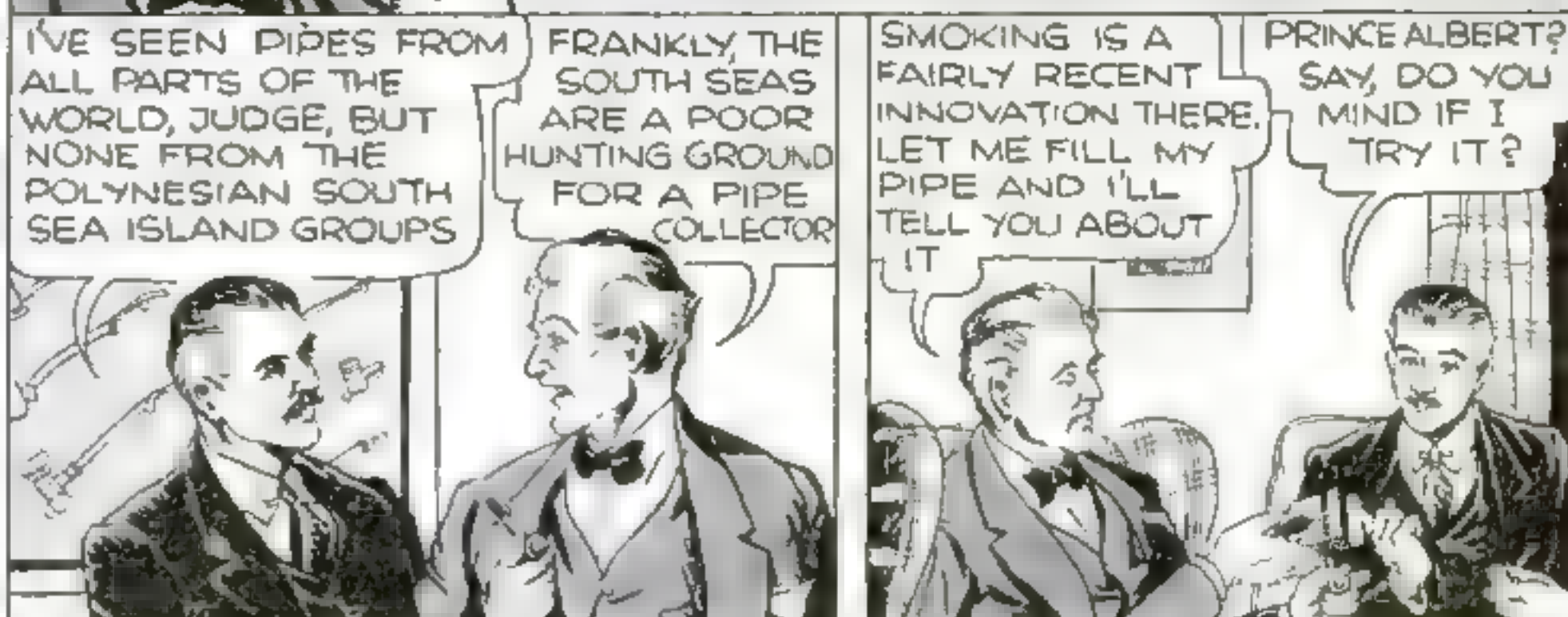
SCREW EXTRACTOR MADE FROM OLD TURNBUCKLE

IN ATTEMPTING to remove a pump head, I broke off one of the bolts. No screw extractor was available, so I made use of the left-hand screw from an old turnbuckle. The end of this screw was ground to a slight taper, and a hole was drilled into the end of the broken bolt somewhat smaller than the diameter of the screw. When this improvised extractor was turned into the hole, the part was readily loosened.



OL' JUDGE ROBBINS

POLYNESIAN PIPE





Amazing Values

\$1.20 to \$2.00

Cross-cut, Rip, Combination
 6" (1/2" hole) \$1.20 8" (1/2", 5/8", 3/4" hole) \$1.60
 7" (1/2" hole) \$1.40 10" (5/8", 3/4" hole) . . . \$2.00
 Also Hollow Ground, \$3.00 to \$5.00

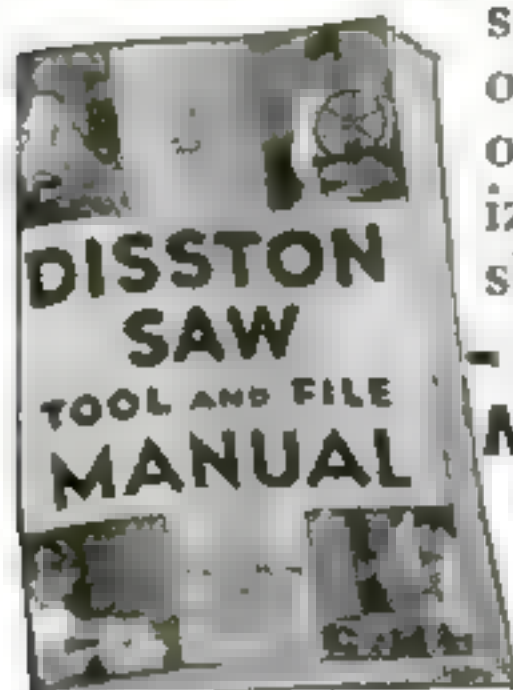
Keystone Disston-made Circular Saws are specially designed by the world's foremost sawmakers, for good craftsmanship in home workshops. They fit your machine and suit your work. They stay sharp!

Keystone BAND Saws—set, sharpened, joined by Disston, ready for your use, \$1.00, \$1.05, \$1.10, \$1.20 each. In Canada, prices slightly higher.

Ask your dealer for Keystone Home Workshop Saws and Tools—Made-By-Disston. Or write us and we will see you are supplied.

LET DISSTON HELP

Disston makes fine Saws, Tools, Files, to give work speed and accuracy . . . to help you excel in craftsmanship. All about these fine tools—how to use them, care for them, illustrated from home workshop photographs, is told in this Disston Manual. Sent FREE with special pointers on getting the most out of your motorized home workshop equipment.



MAIL COUPON

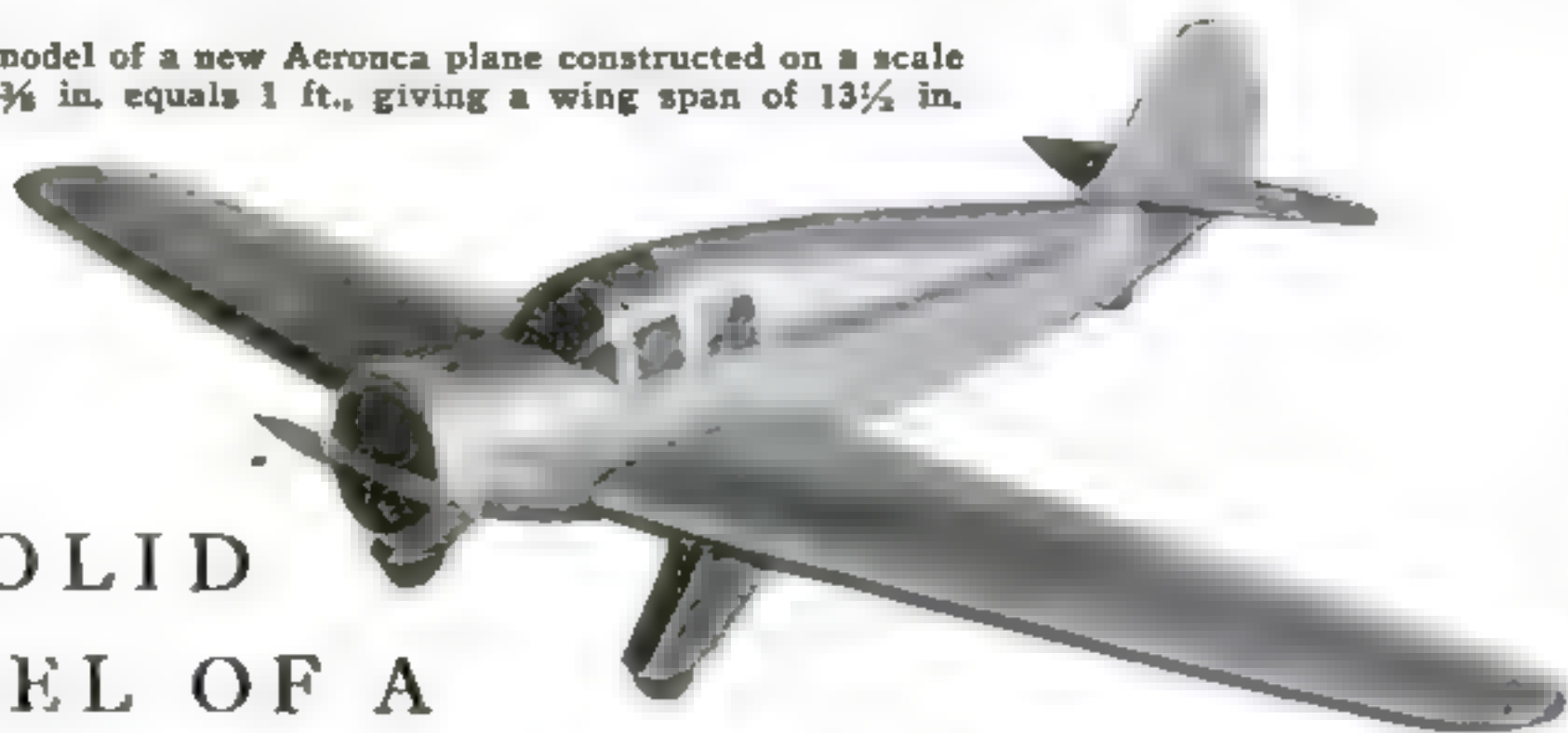
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 & SONS, INC.
 210 Tacony
 Philadelphia, U. S. A.

Send me free copy of "Disston Saw, Tool and File Manual."

Name.....

Address.....

A model of a new Aeronca plane constructed on a scale of $\frac{3}{8}$ in. equals 1 ft., giving a wing span of $13\frac{1}{2}$ in.



SOLID MODEL OF A POPULAR Low-Winger

By
DONALD W. CLARK



The surprisingly few parts are shown below. Only hand tools are used, even for rounding the engine cowl. The cowl recess is darkened with black drawing ink as at the left

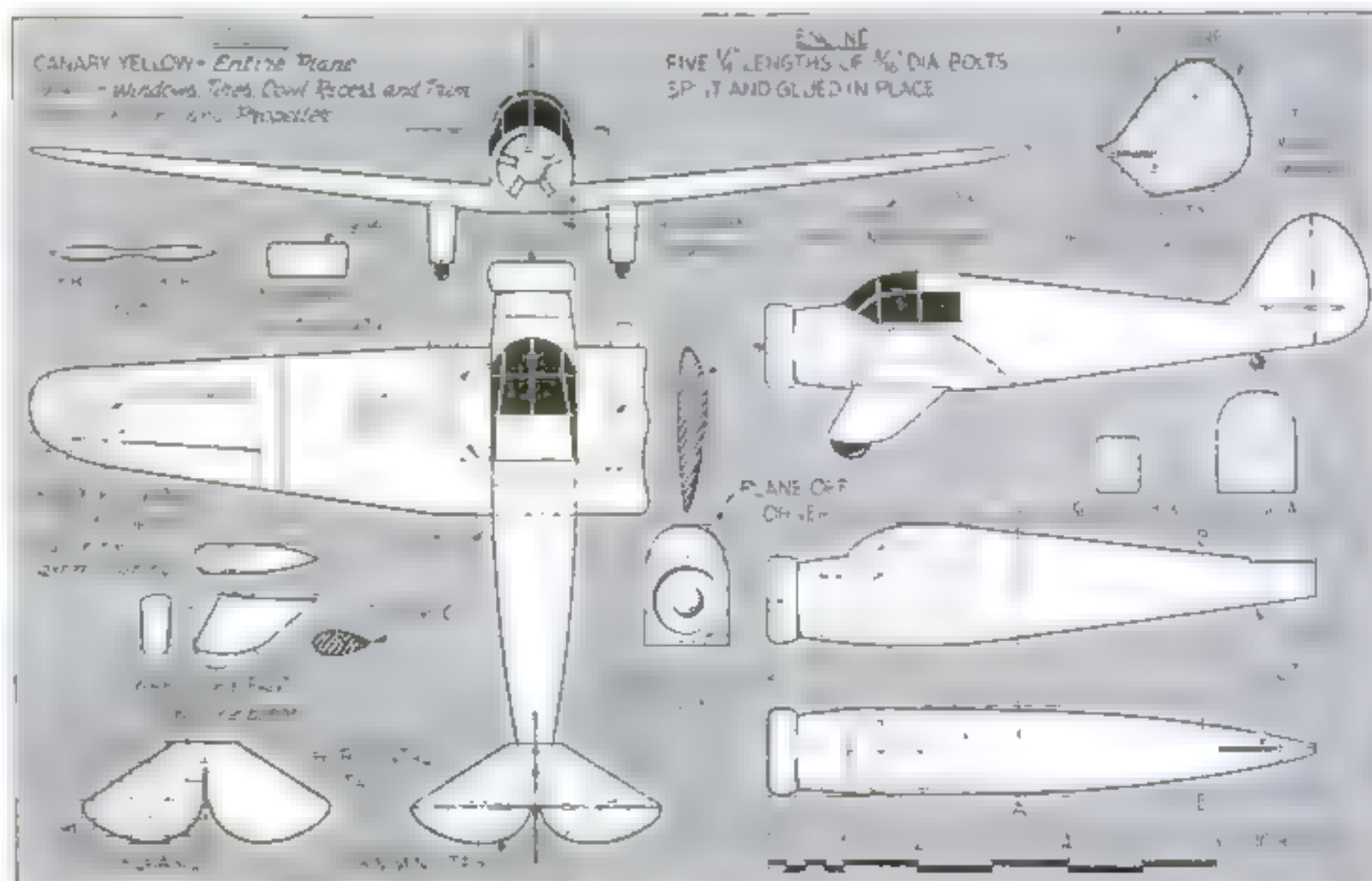


A POPULAR two-place airplane of the low-wing type is the new Aeronca model LA. This trim little ship is designed for advanced training, chartered trips, and private use, and has a cruising speed of 100 m.p.h. It has a roomy cabin, excellent visibility, and the clean lines of a modern transport plane. A small air brake underneath the fuselage helps reduce the landing speed, which is 48 m.p.h.

The span is 36 ft.; length, 21 ft. 11 in.; height, 7 ft.; weight empty, 1,036 lb.; useful load, 644 lb.; baggage, 121 lb.; fuel, 28 gal. The engine is a Le Blond 70 h.p. at 1,950 r.p.m. Maximum speed is 115 m.p.h.; cruising speed, 100 m.p.h.; service ceiling, 13,000 ft.; climb per minute, 600 ft.; landing speed, 48 m.p.h.; cruising range, 500 miles.

The scale of the model is $\frac{3}{8}$ in. equals 1 ft.

The eleven simple parts (not counting the engine cylinders) are easy to shape and assemble. They are of soft pine except as noted on the drawings. The engine cowl of the model shown was made by hand with only a knife, razor blade, small chisel, and a bit of sandpaper held on the end of a $\frac{3}{8}$ -in. round stick. If cardboard is used for the tail units, they can be glued in place, thus doing away with the lock pin. It is a good idea also to use glue when pinning the wings.



First cut the stock for the fuselage and wings to the blank sizes given, then draw the outlines

GUILD PROGRAM BUREAU PRAISED BY CLUBS

LETTERS of enthusiastic praise for the Program Service Bureau of the National Homeworkshop Guild are pouring into headquarters from clubs throughout the country. With more instructive and entertaining program features now available, the clubs report increased attendance at meetings, and they are consequently planning broader and more inclusive activities for 1937.

The latest reports from clubs affiliated with the Guild follow:

Rockford (Ill.) Homcraft Club. Working in conjunction with the local Art Association, the club has arranged for classes to be conducted at the club workshop. Instruction will be given in pottery making, both by molding and on the wheel; wood finishing, use of the metal-cutting lathe, and art-metal work. Kenneth Dike is in charge of arrangements. . . . Each member of the board of directors has agreed to be responsible for one meeting during 1937. Educational moving pictures



Henry Wagner, secretary, and, at right, Emil Ctr, president of the Chicago Premier Homeworkshop Club. Both the novelty cigarette box and the model of the Hartford were made from *Popular Science Monthly* plans

will be shown at every other meeting, and some of the programs already scheduled cover such subjects as stonecutting and polishing, astronomy, navigation and the use of navigating instruments, duplicate wood turning, and machine shop practice. A screw-cutting lathe, jig saw, and a wide variety of hand tools have been donated for the club workshop, which will soon be completely equipped. . . . F. K. Bailey was elected chairman at the annual meeting; Frank Burritt, vice chairman; Paul Abramson, secretary; R. P. Drake, treasurer. New members on the board of directors are E. J. Davis, R. G. Alcock, and LeVern T. Ryder.

Tri-City Homeworkshop Club, LaSalle, Peru, and Oglesby, Ill. Nearly all the members participated in a craftwork exhibition held in a local hardware store. . . . Walter Menning and Earl Gealow demonstrated how to grind and sharpen tools for the metal-cutting lathe at a meeting at the home of Joseph C. Rucinski. Ray S. Lindenmeyer showed how to sharpen woodworking tools. The club decided to participate in the Guild contest. . . . Mr. Lindenmeyer demonstrated wood turning at a recent meeting at the home of H. M. Cobleigh. Six new members have joined the club.

Capital Homcraft Club, Washington, D. C. The designing and construction of a project for entry in the Guild contest was the feature for a recent meeting at the home of Joseph Chlopicki, who has an exceptionally well-arranged and well-equipped shop. . . . A number of new members have been added as a result of the successful exhibition held in a telegraph company's window. Wood turning was demonstrated recently at the home of George C. Gadde. A barter and sale department has been organized. *(Continued on page 106)*

FREE TO HOMECRAFTERS!

New, Exclusive Projects by Famous Designers

BIG NEWS! For the third successive year, Casein Company, makers of CASCO, famous heatproof and waterproof glue, offers a Free Project Service to homecrafters. And for 1937 it's bigger and better than ever before!

Here is the kind of projects homecrafters have asked for. We know because we asked them—thousands who built from Free Casco plans in 1935 and 1936.

We didn't stop there! We retained famous authorities to design these "request" projects, assuring originality of design and genuine usefulness. And we have put these projects in simple, compact form...easy to follow...a pleasure to build...a joy to possess.

Twenty-four exclusive projects in all—sailboat, kayak, surfboard, modern tables and cabinets, inlaid card table, colonial desk, etc. Some for hand tools...others for power tools...some simple...others more challenging to your skill. In this enlarged service you're sure to find something you want to build.



A New Class "Plover" Sailboat. One of a series of water projects designed by William Crosby, Editor of *Rudder Magazine*.



Modern End Table Radio Cabinet. One of a group of eight modern tables, desks and cabinets by Gilbert Rhode, internationally famous furniture designer.



HOW YOU GET FREE PLANS

Fill out and mail the coupon below. You get by return mail an illustrated folder picturing and describing all 24 of these interesting projects. Take your choice. Then mark that choice on the green ticket which is in every 25c (or larger)

can of CASCO. Each ticket entitles you to one FREE Plan. Plans come complete—not merely blueprints, but all-inclusive instructions. This Free Project Service is designed for you. Get your can of CASCO today.

FREE!

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Unlike ordinary glues and pastes which set merely by evaporation, CASCO sets chemically like concrete. Heat, moisture and rough usage will not affect it. For permanence, use CASCO on your next project.

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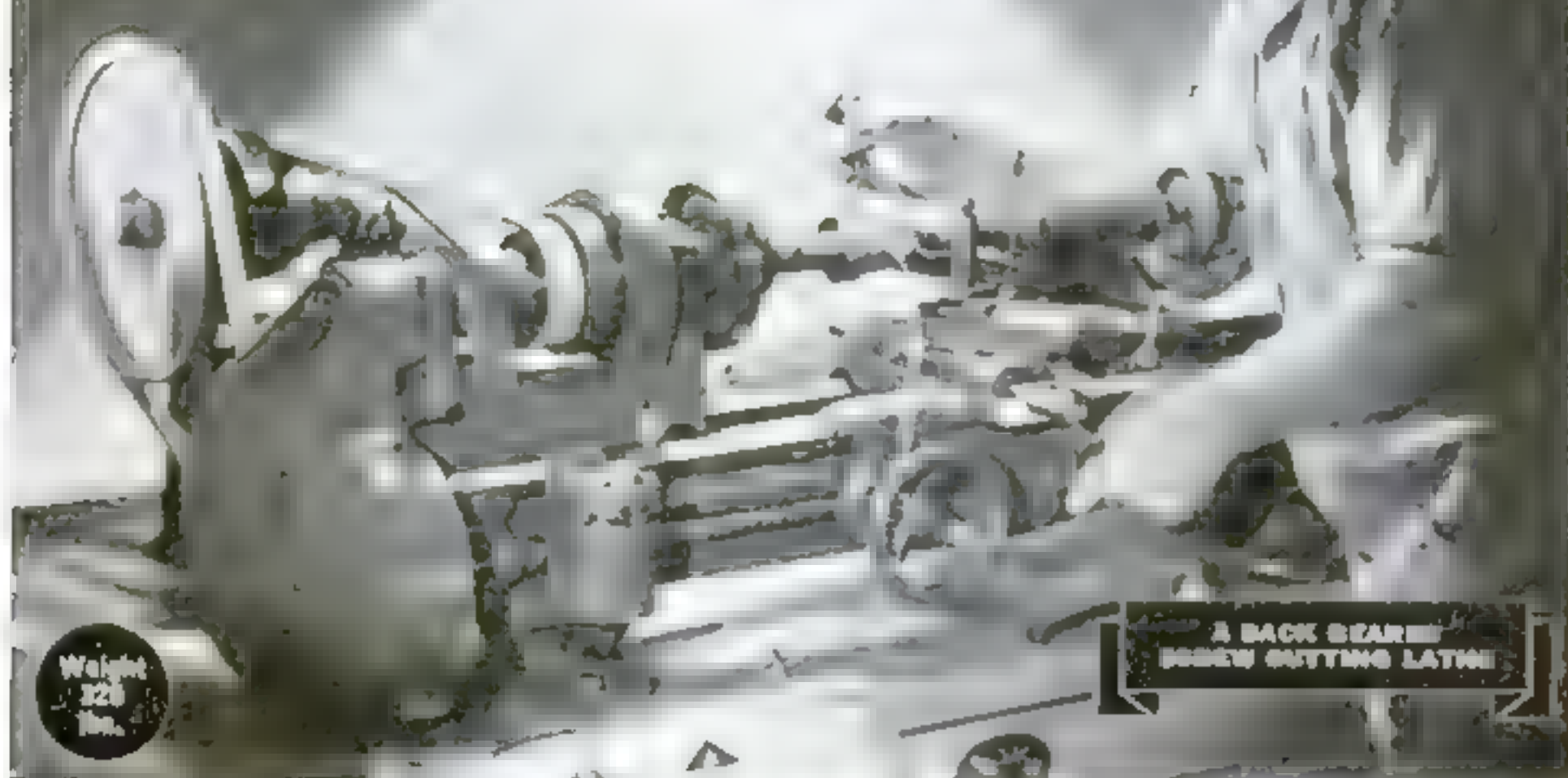
LESS MOTOR DRIVE

TERMS AS LOW AS

\$7.00

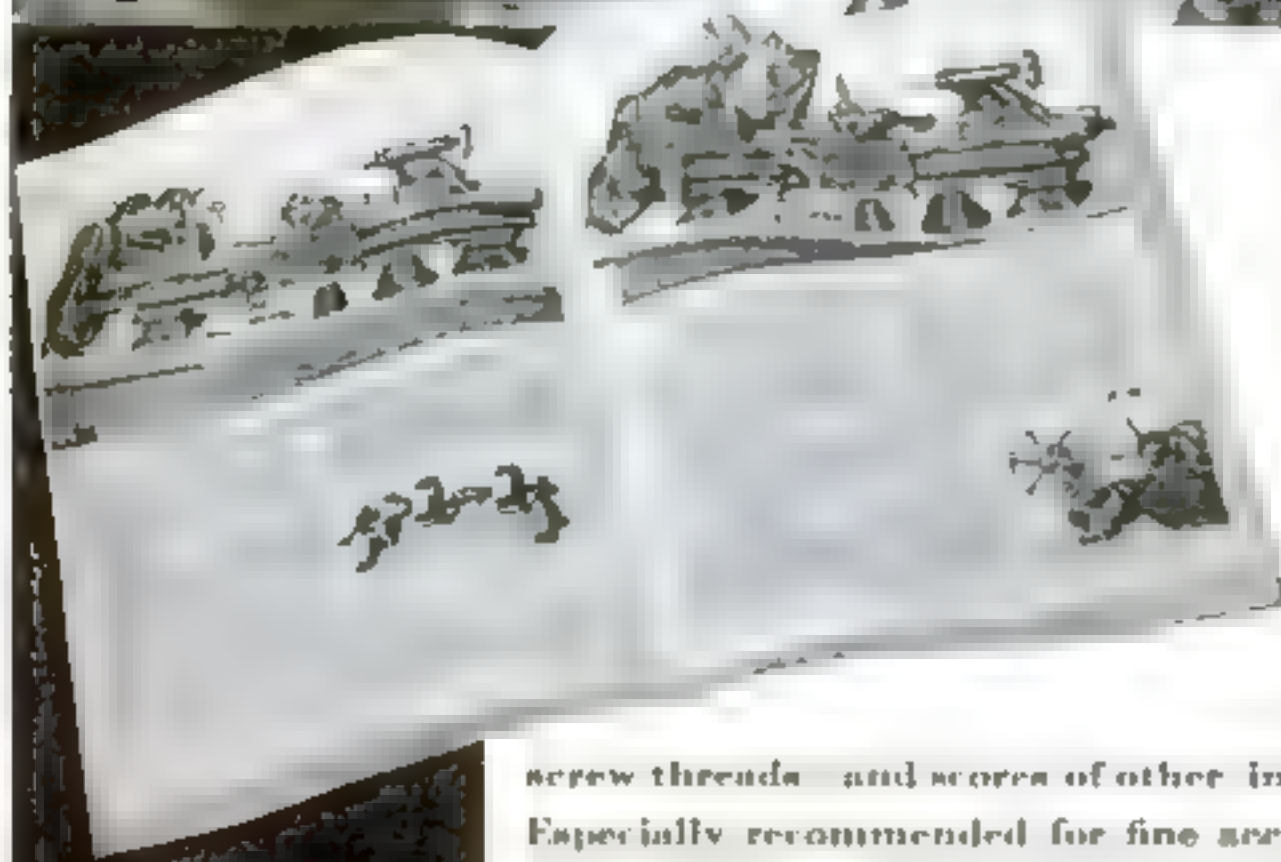
A MONTH

New 1937 SOUTH BEND PRECISION LATHES



Weight
320
lbs.

A BACK GEAR
SCREW CUTTING LATHE



No. 415-YA 9" swing by 3' bed
Workshop Lathe with Horizontal
Motor Drive, 1/2 h.p. Reversing
Motor, Switch and belt tension
countershaft as shown **\$116**
\$29 Down, \$8 a mo. for 12 mo.)

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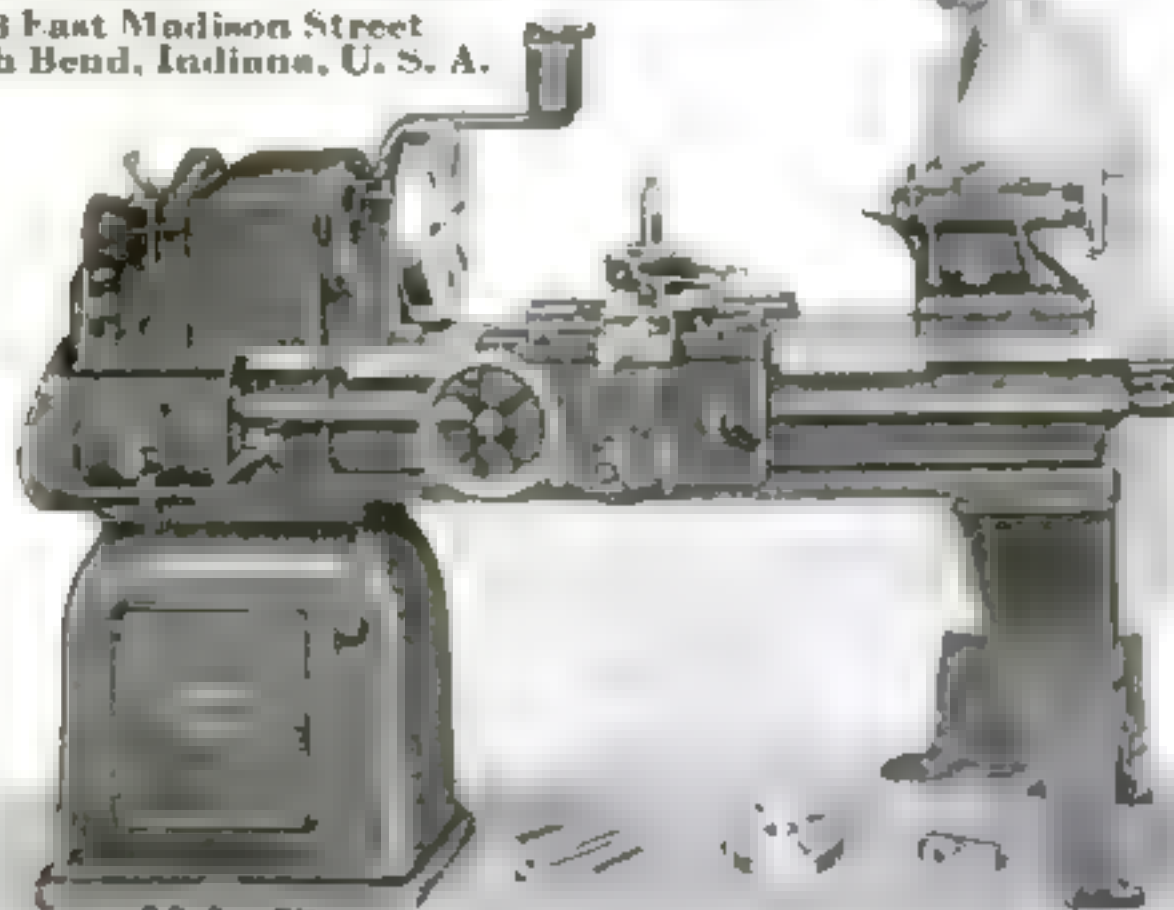
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SWING. In all bed lengths. Priced
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SOUTH BEND Precision LATHES

HOME WORKSHOP CLUBS

(Continued from page 105)

Ship Craft and Model Engineering Guild, Cincinnati, Ohio. Interest is being stimulated in the various branches of model making, and construction will start soon on several gas model planes. The club plans to install a track layout for those interested in HO-gauge model railroading, the members furnishing their own motive power and rolling stock. Because of the interest shown, two meetings a week are being held in the club workshop. The club has several power tools, and a large jig saw was added recently. William Richards directs the club activities.

Sunset Social and Hobby Club, Brooklyn, N. Y. The club celebrated its first anniversary with a handicraft exhibition. Robert Hasselo won the first prize—a year's subscription to *POPULAR SCIENCE MONTHLY*—with a model of a section of an airplane wing. James Arnish was second with a workbench of his own design and an electric shock machine.

Louisville (Ky.) Homeworkshop Club. Plans are being made for participation in the Guild contest. Moving pictures have been shown at several meetings.

Club des Artisans Amateurs, Trois Rivières, P. Q., Canada. A group of members visited the home workshop of G. C. Richard, who gave a demonstration on the bench saw, planer, shaper, and band saw, and also explained how to sharpen wood-turning tools.

Saginaw (Mich.) Homcraft Club. Because of the enthusiastic participation of all the members, the club was able to exceed its goal and made nearly 500 toys for Christmas.

Topeka (Kans.) Homeworkshop Club. Many of the members won blue and red ribbons for exhibits at the Kansas Free Fair. A delegation from the Holton club attended a recent meeting.

Craftwood Club of British Columbia, Vancouver, B. C., Canada. Approximately \$500 has been invested in tools for the club's workshop, which contains elaborate power equipment as well as hand tools. At present the members are making cupboards and furniture for the shop. Soon after the club was organized, the members visited the Vancouver Homeworkshop and Wood Carvers Club of the same city. The officers of this new club are Joseph Henry Ruddick, president; Gary McGavin, vice president; John McLean, secretary; Phill Dobby, treasurer.

Yakima (Wash.) Homcraft Club. Organized in April of 1934 with ten members, the membership doubled in 1935, and during 1936 the number of active men grew to 60 under the leadership of Floyd Norgaard, president, and Earl Brown, vice president. An amateur home workshop exhibition is held each spring.

Lowell (Mass.) Homeworkshop Guild. Meetings are held on the second and fourth Tuesdays. One meeting a month is devoted to making one-evening projects, but speakers and other entertainment are scheduled for the other meeting.

Winfield (Kans.) Homeworkshop Club. J. H. Douglas, manual training instructor at the local high school, gave a talk on furniture designing, glue problems, and wood turning recently. The club decided to hold a local three-hour project contest and enter the winning design in the Guild's national contest.

St. James Workshop Club, Montreal, P. Q., Canada. Membership has increased to fourteen, and the club workshop has been improved.

Home Workshop Club of Independence, Mo. Organized with seven charter members, the club expects to have at least thirty when its drive is completed. Harold Riggins is president; Ellis Rauh, vice president; Lloyd F. Howe, secretary, and Earl Howe, treasurer. On the board of governors are the officers and Marion Keir, A. W. Budd, and A. F. Baldwin.

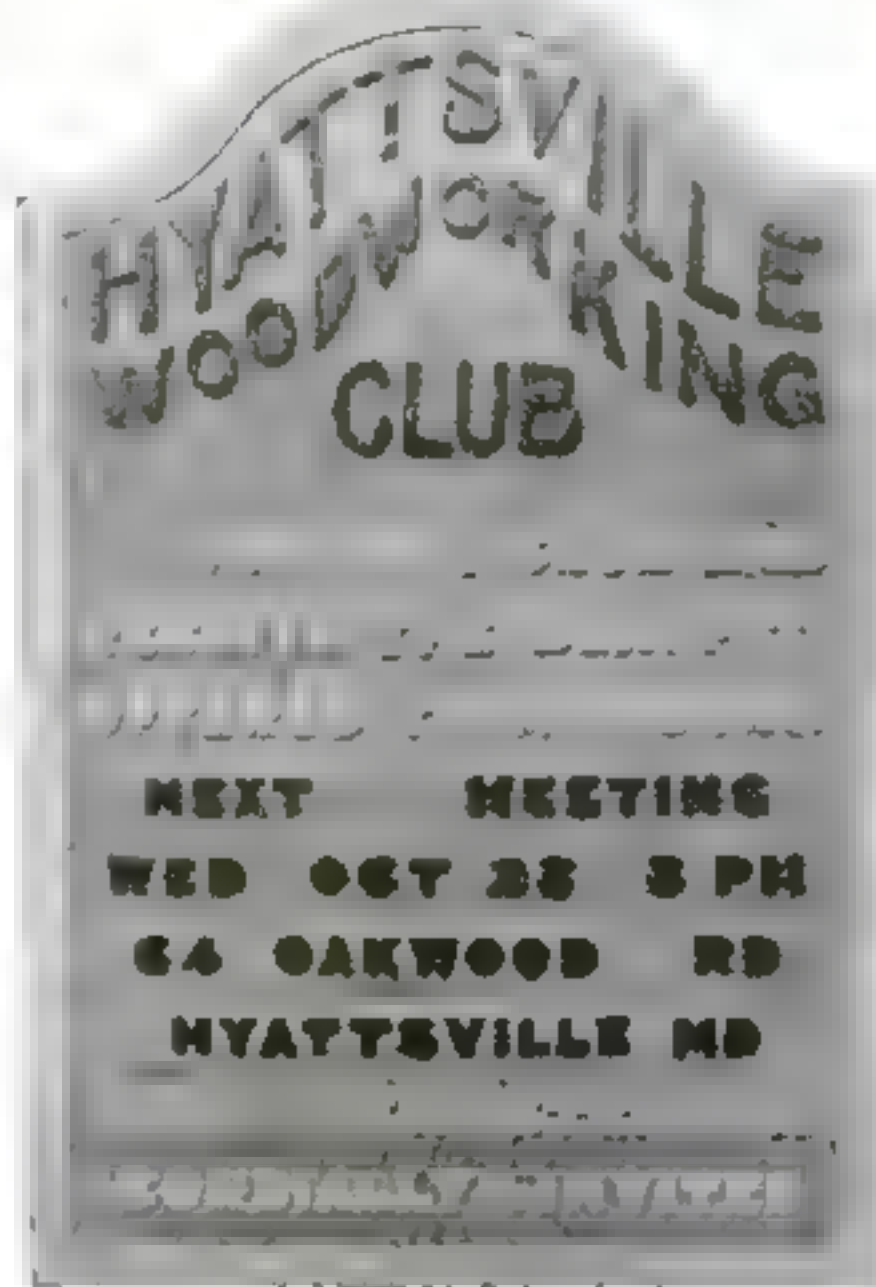
(Continued on page 107)

HOME WORKSHOP CLUBS

(Continued from page 106)

Galesburg (Ill.) Homeworkshop Club. Sixty-five members and friends attended a meeting in the shop of B. M. Kidder to hear a talk by Earnest Elmo Calkins of New York, noted advertising man, author, and hobbyist.

Dover (N. H.) Homecraft Club. Fall activities included a picnic attended by twenty-two members and many interesting meetings. At one meeting the president, J. C. Tonkin, gave a demonstration of soldering and explained some of the problems involved. Another night was devoted to old or unusual tools, and one member brought an axe of odd design made in Sweden. Settee benches for the club members to use at meetings were made at a special session held in the pattern



Signs like this are placed in hardware stores by the Hyattsville (Md.) club

and cabinetmaking shop of the University of New Hampshire. Three types of toys—a doll's cradle, a small chest, and a small wheelbarrow—were made in quantity for the Red Cross to distribute at Christmas.

Coulee Dam (Wash.) Homeworkshop Club. Three new members have been admitted. They are K. S. Brown, a photographer; Leonard Engvall, who is constructing the furniture for his home; and J. S. Sowle.

Great Falls (Mont.) Homeworkshop Club. The members made one-evening projects complying with the Guild contest rules and exchanged them at the December meeting. The best project will be entered by the club. . . . A recent meeting was held at the local Y.M.C.A. where the staff has decorated several rooms in various motifs. Work is now in progress on a Dutch room under the direction of the Y secretary, L. W. Upshaw. . . . Examples of metal spinning and work in plastics were shown at a meeting in the home of Clarence Beaulaurier.

Hyattsville (Md.) Woodworking Club. Several wooden signs of the type illustrated have been made and placed in local hardware stores and other public places. The first one was constructed by W. H. Koppialky, vice president. The smaller letters on the sign are made in strips of the desired shape and sliced off with the circular saw about 1/8 in. thick. The lines of words are mounted on rabbeted strips and may be changed by removing the right frame strip.

Edmundston (N.B., Canada) Hobbyists. A large number of Christmas toys were made for distribution to needy children. An exhibition is planned for February.

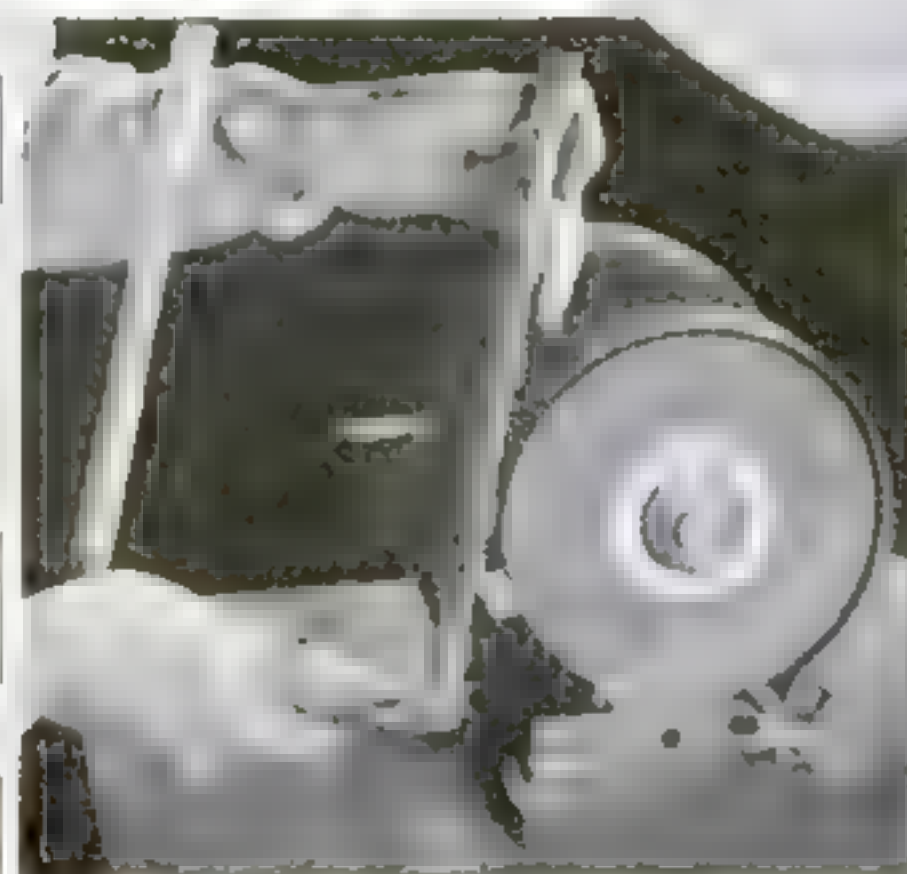
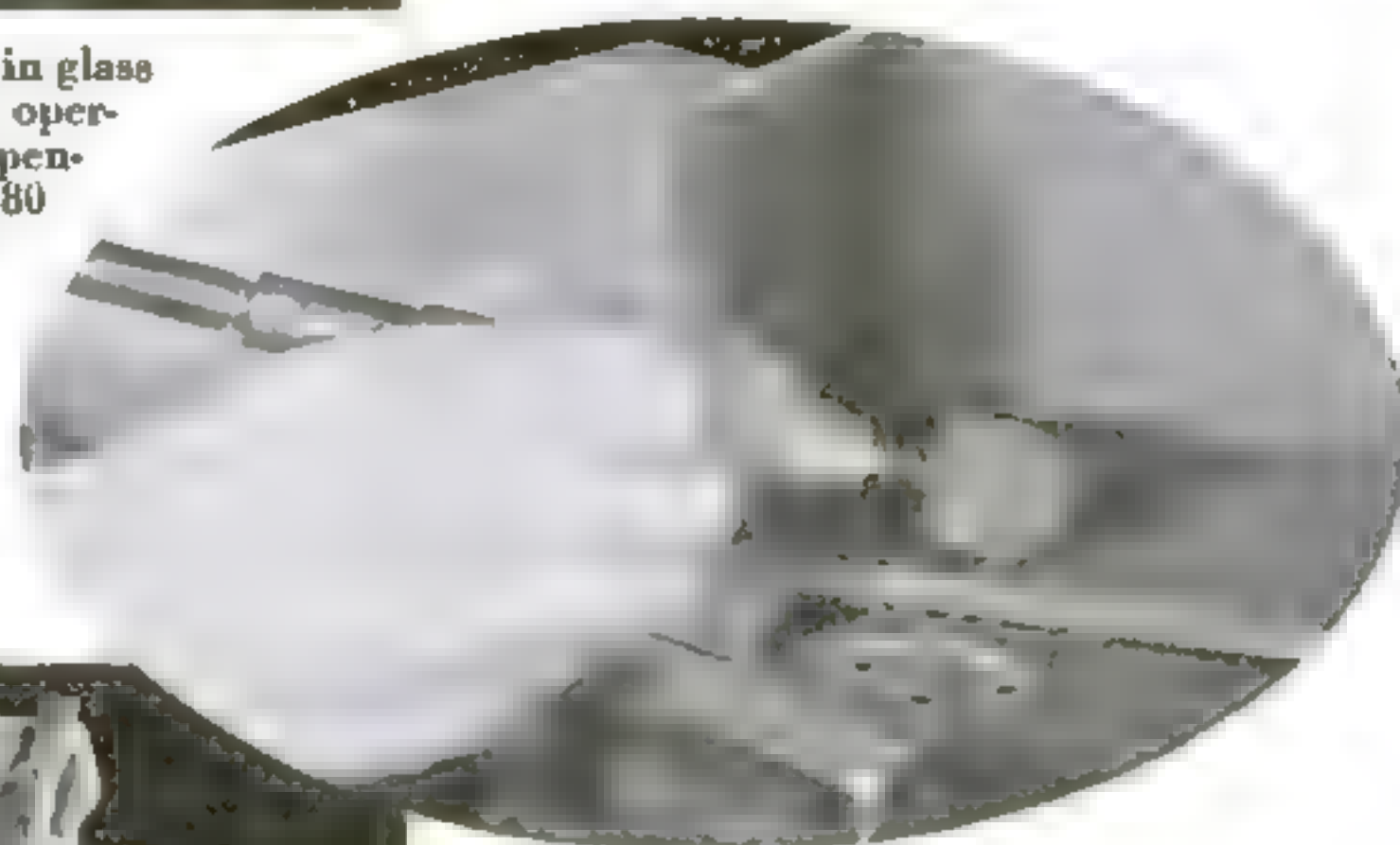
WORKSHOP FANS

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ABOVE Drilling hole in glass bottle with brass tube operating in a pool of turpentine containing No. 80 Carborundum grains.

RIGHT Removing projecting end of wood screw with mounted wheel without damaging surrounding wood surface.



ABOVE Smoothing a hard metal welded joint with an Aloxite Brand Grinding Wheel. For soft metals a Carborundum Brand Wheel is used.

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EASILY MADE PHOTO PRINTING BOX

(Continued from page 98)

The momentary contact switch used to turn on the lights for the exposure is merely an automobile stop-light switch, which may be purchased from a dealer in auto supplies. The arm of this switch is extended with a 3/16-in. brass rod. Drill a 1/8-in. hole in the end of the brass rod; then machine or file the arm of the switch down to 1/8 in. and solder or "sweat" it in place. Drill a hole in the top of the printing box where the extension rod strikes, and adjust the height of the switch so that it closes contact when the lever arm is pushed down and the parts of the elbow catch snap together. Screw the switch in this position.

An alternative method of extending the arm of the switch would be to use 3/8-in. wooden dowel stock.

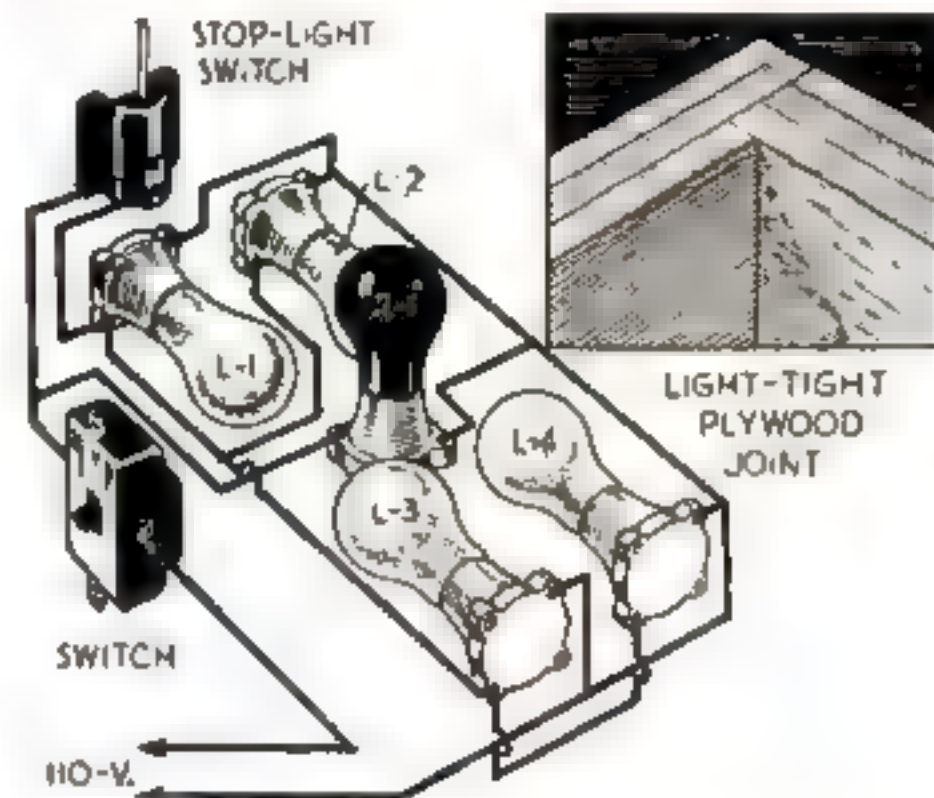
The chain is fastened with small screw eyes, the length being adjusted to raise the platen and allow the lever to be raised in a vertical position.

The wiring and arrangement of lights is shown in the diagram. One 25-watt photo-red lamp and four 40-watt lamps are used. The white cardboard reflector improves the illumination. Some builders of printing boxes, especially if only one or two lamps are used, insert a piece of flashed opal glass to diffuse the light more completely, although the au-

thor did not find it necessary to do this.

The top is held in place with neat turn buttons—1/2-in. pieces of 1/16-in. brass cut from an old hinge, the holes being off center. Hinges could be used at the back, if preferred.

Give the inside a coat of flat white paint and finish the outside with varnish or shellac.



Methods of making light-tight joints with plywood, and wiring diagram for the printer. R-1 is a 25-watt photo-red lamp; L-1, L-2, L-3, and L-4 are ordinary 40-watt inside frosted lamps.

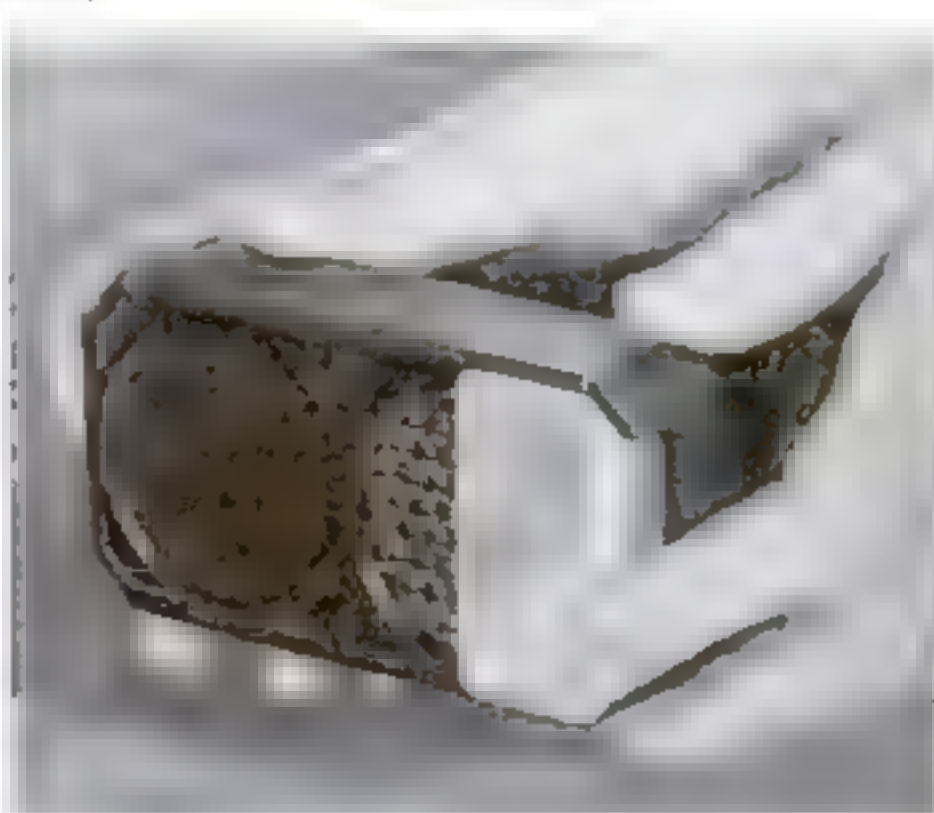
COVER INCREASES RANGE OF EXPOSURE METER

PHOTOGRAPHERS who use an exposure meter of the photocell type—and more and more amateurs are learning what an invaluable accessory such an instrument is—sometimes find that the meter is useless because the light value of the scene is entirely beyond the range of the dial. This may happen, for example, in attempting to take a reading in the snow or at sea when a dazzling sun is shining, or if the principal object in a scene is unusually brilliant.

It is easy to overcome such a difficulty, however, and increase the range of the meter in the higher light-value end by allowing only half the light to enter the cell and then doubling the reading obtained. Be careful to get the exact reading because any error is doubled.

To find just how much to cover the meter, place it in a fixed position in relation to an electric lamp or other constant light source. Note the reading obtained; then slide a card over the front of the cell opening and reduce the amount of light until the new reading equals exactly half the former. The card may then be used as a pattern for making a cover like that illustrated below from aluminum or other light sheet metal.

Since this cover fits around the corner of the meter, it will rest in the meter case, ready for use when necessary.



Meter with half cover in place so it can be used to measure light from very bright scenes

USING MIRROR TO STUDY GROUND-GLASS IMAGE

ONE objection to the ordinary type of film-pack camera is the fact that the image on the ground glass appears upside down. For purposes of composition, an upright image is sometimes desirable. This can be had quite simply by inserting a small hand mirror into the back of the focusing hood as shown above.

If the mirror is placed at 45 deg., the entire image on the ground glass can be seen by looking down at the mirror. A small hole may be punched in the top of the focusing hood, if desired, so one can look directly at the image.—HOWARD JOHNSON.

THREAD GLUED ON MODEL HULL FOR PAINTING WATER LINE

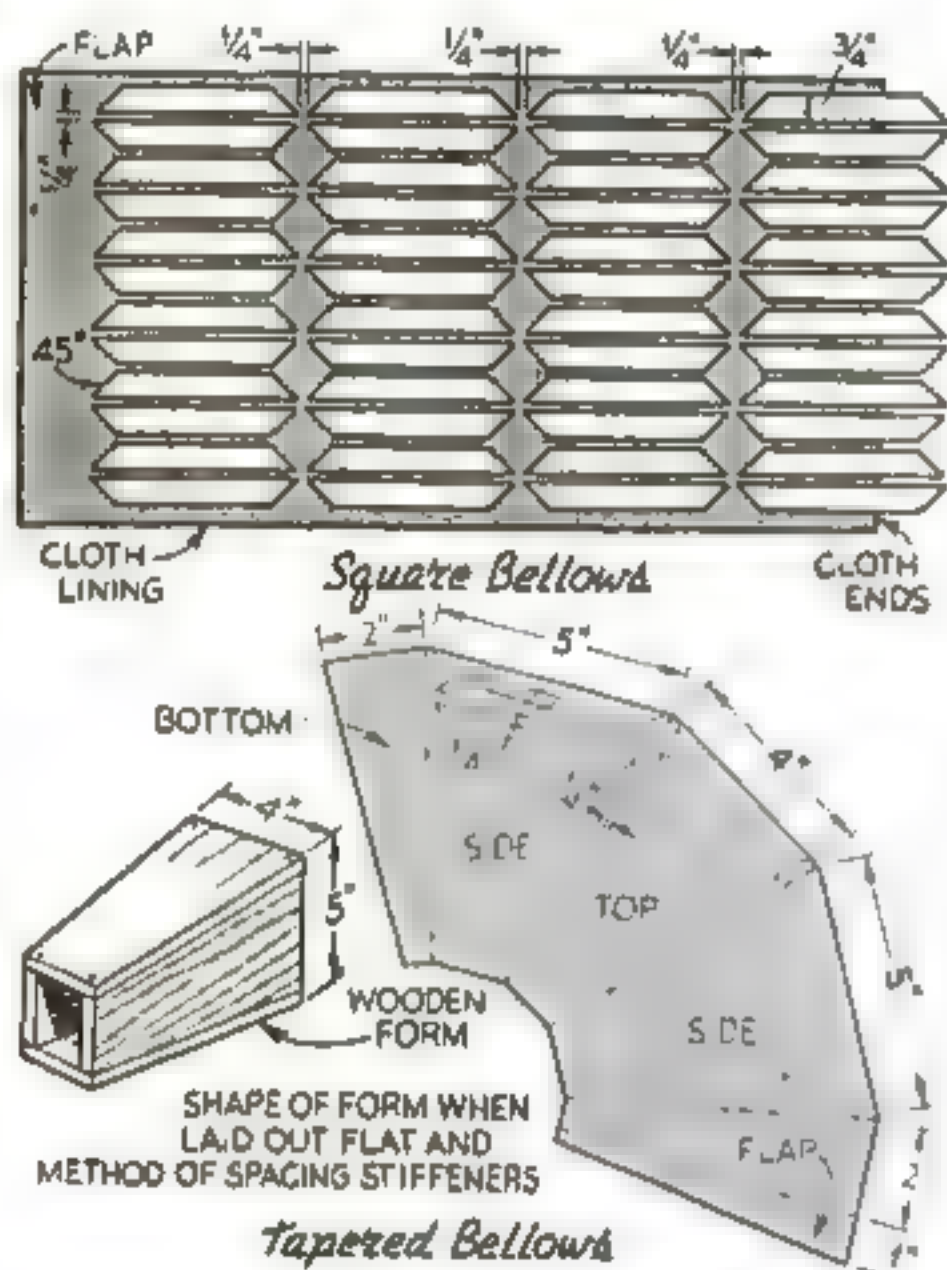
WHEN it is difficult or inconvenient to use masking tape in painting a clean-cut water line on a ship-model hull, the same result may be obtained by fastening a very thin cotton thread to the dividing line by means of a light adhesive. The thread serves as a guide to keep the paintbrush from crossing to the wrong side and insures a much neater job than if the line is painted free-hand. This idea can be utilized for almost any kind of painted division lines on models or similar small work.—HAROLD KROLL.

TWO WAYS OF MAKING CAMERA BELLOWS

IN MAKING bellows for a camera or an enlarger, I have used two methods. Square bellows are easier to construct and serve most purposes, but tapered bellows are sometimes needed as replacements.

Square bellows. Spread enough lightweight, black cotton cloth on a table to form the lining, and paste a sheet of thin wrapping paper over it. Draw the plan of the folds as shown. Cut strips of stiff cardboard (not too heavy) $\frac{3}{4}$ in. wide, shape the ends to 45 deg., and paste on the wrapping paper. Allow $\frac{1}{4}$ in. between the stiffeners and along the edges. The outside covering can be made of thin leatherette or green shade cloth. Paste it over all but the flap, and let it dry under pressure overnight. Make all the creases, then paste the flap under the projecting stiffeners on the other side, and fold the bellows up.

Tapered bellows. Make a form of wood the size of the bellows desired. As an example, a form for a 4 by 5-in. plate camera is shown



How to lay out square and tapered bellows. The latter are best made over a wooden form

If the sides are marked on a piece of paper by tracing around the form and then rolling it over in order to outline each side successively, they will appear as shown. Make the stiffeners $\frac{3}{4}$ in. wide in this case. Paste them to the lining after wrapping the lining around the form; then paste on the outside cover. Take care to allow some extra covering material at the front and rear for attaching to the enlarger or camera. Slip the bellows from the form and fold it up like an accordion. Patience and care are essential for this operation. If required for attaching the bellows to the lens board, cut a piece of cardboard for the front with a hole in it opposite the lens opening.

Before undertaking to make bellows at all, it is advisable to look around in local pawnshops, because sometimes an old camera without a lens but with good bellows can be picked up at trifling expense. A friend of mine recently made excellent bellows out of a discarded accordion.—GEORGE A. SMITH.

SIGNATURES ON PHOTOGRAPHS

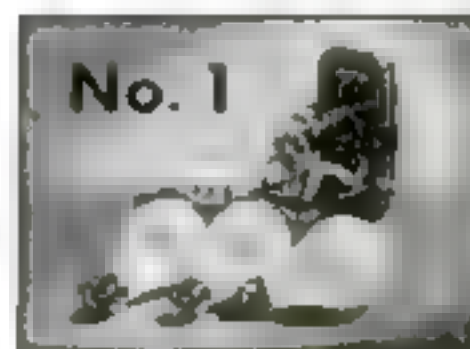
SIGNATURES and dates may be made to appear in white on the face of photographs by writing them with a very soft lead pencil in a corner of the sensitized paper just before it is exposed. Expose and develop as usual. The lead-pencil marks will wash away, leaving the white paper beneath.—ROBERT BRIGHTMAN.

OH!
for a SNAPSHOT NOW!

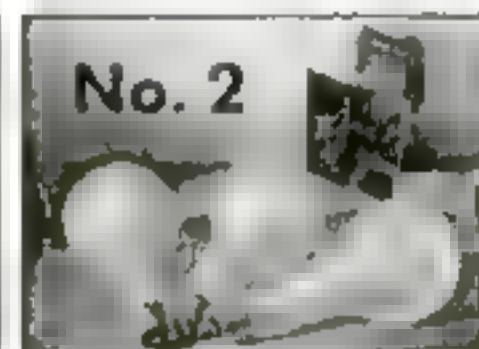


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Make of car _____ No. of Cyls. _____

Body type _____ Model No. _____ Year _____

HOMEMADE ELECTRIC ANEMOMETER

(Continued from page 95)

toy mechanical sets is clamped to the upright shaft as shown. This gear has three threads to $\frac{1}{2}$ in. It is about $\frac{7}{8}$ in. in length and is threaded for $\frac{1}{2}$ in. of its total length. A set screw is inserted in one end as shown. As the hole in this gear is only $\frac{5}{32}$ in. in diameter, it must be reamed out to fit on the $\frac{3}{16}$ -in. shaft.

The worm gear meshes with a small gear wheel clamped on a short shaft and supported by two $\frac{1}{16}$ -in. brass ears, which are drilled to form two simple bearings. These are bolted or well soldered to the upright casing or body of the anemometer. The gear wheel itself has an outside diameter of $\frac{5}{8}$ in. and has eight teeth.

An anemometer with the cup sizes and arm lengths used in this one will revolve approximately 500 times with the passage of one mile of wind. In order to find the current wind velocity, it will be necessary to reduce the mile readings to $\frac{1}{60}$ the total wind mileage; therefore our anemometer must close a contact every 8 turns instead of every 500, allowing 20 turns loss for friction. In this way it will be necessary only to find out how often the cups revolve 8 times in one minute, each 8 turns indicating $\frac{1}{60}$ of a mile of wind.

A small screw on the gear shaft closes the contact for every turn of the gear wheel by



Buzzer, transformer, and switch, as mounted

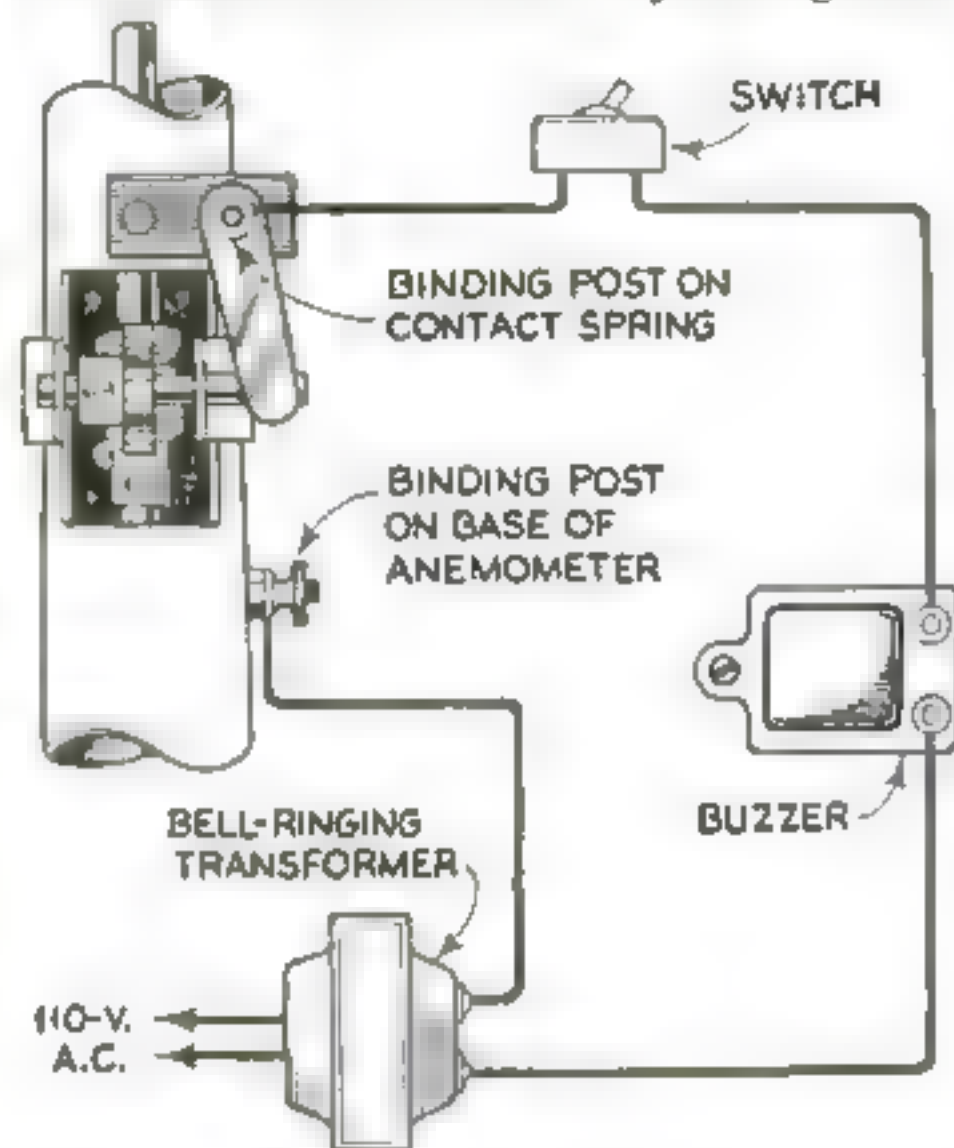
rubbing against a small strip of brass as shown. The contact and the gear are protected from the weather by a small cover made of thin galvanized sheet iron or brass.

The bottom of the anemometer is fitted with a set screw so that it may be mounted on a 1-in. pipe support.

A buzzer and transformer or dry cell should be connected with the anemometer as shown.

To find the wind velocity, it is necessary only to turn on the current with the switch. The number of buzzes in one minute indicates the wind velocity in miles per hour.

The finished instrument requires reasonable care, and the bearings should be oiled occasionally with clock oil. The whole mechanism should be cleaned twice a year in gasoline.



The wiring diagram. The number of buzzes a minute shows wind velocity in miles an hour

BATTLE-CRUISER TURRET HOLDS CIGARETTES

(Continued from page 91)

stores carry the size shown. Take a small piece of waste stock from the turret and use it as a spacer. Place the ends of each staple in a vise, allowing it to extend the width of the spacer. Remove the spacer, bend the brad at right angles, and the rung is in the proper shape. Then, instead of using pins, merely drill snug holes and solder all rungs at one time from the inside.

The doors can be made of the same stock as the turret. Bear in mind that they represent openings through which men are required to crawl, so their small size is in actual proportion. The corners are rounded and all edges are beveled. Hinges and an L-shaped handle may be added, if desired.

THE "ears," which are sighting and range devices, are quite tricky to build and attach. They leave the turret on a horizontal plane and join the turret on the curved portion of the sides. It is easier, and probably better, to complete both before attempting to attach them. The shafts are flat on top and bottom, with front and rear rounded. A piece of flattened tubing will serve very well. The ends are squared off, and the windows should be made to the size and shape shown on the front view, to be attached last. The taper is on the top and bottom while the sides are vertical. This assembly may be made over a wood block template or in any suitable way, then filed down to shape. The edges here, as well as all edges on the turret, should be straight along the joint, but filed enough to remove the sharp edge effect. The window hole may be beveled, and the "glass" should be metal.

The cigarette box is merely a metal box.

The cut-outs fore and aft are finger holes to reach the bottom row of cigarettes. The forward end has a bumper or silencer, made by threading rubber tubing over brass rod and bending the ends into holes in the box. The ends of the rod should be soldered after the tubing is clamped down, or squeezed. Clamp snugly enough so the stress of the tubing will be up; this will prevent the solder from giving way should the top fall. There is a small space available in the curved back of the turret to build up a counterweight, which should be near the top, inside.

The entire turret should rest on a barrette, which is represented by a 3-in. outside diameter brass pipe or slightly smaller size. It might be a little neater if the pipe extends slightly into the wood, which will make the painting easier. Three or four wood screws countersunk through the bottom of the cigarette box will be ample to secure the turret.

The turret may be made to rotate, just as the prototype does, and if so the barrette should be similar to the one shown.

The deck should be about the size shown and of any suitable light wood. The planking is scribed with a sharp, hard pencil and straightedge rather than cut with a knife. The pencil will leave enough color to give the proper effect and will also serve to spot nail holes, which tend to improve the appearance if applied evenly. Four rubber knobs or chair glides are required under the base.

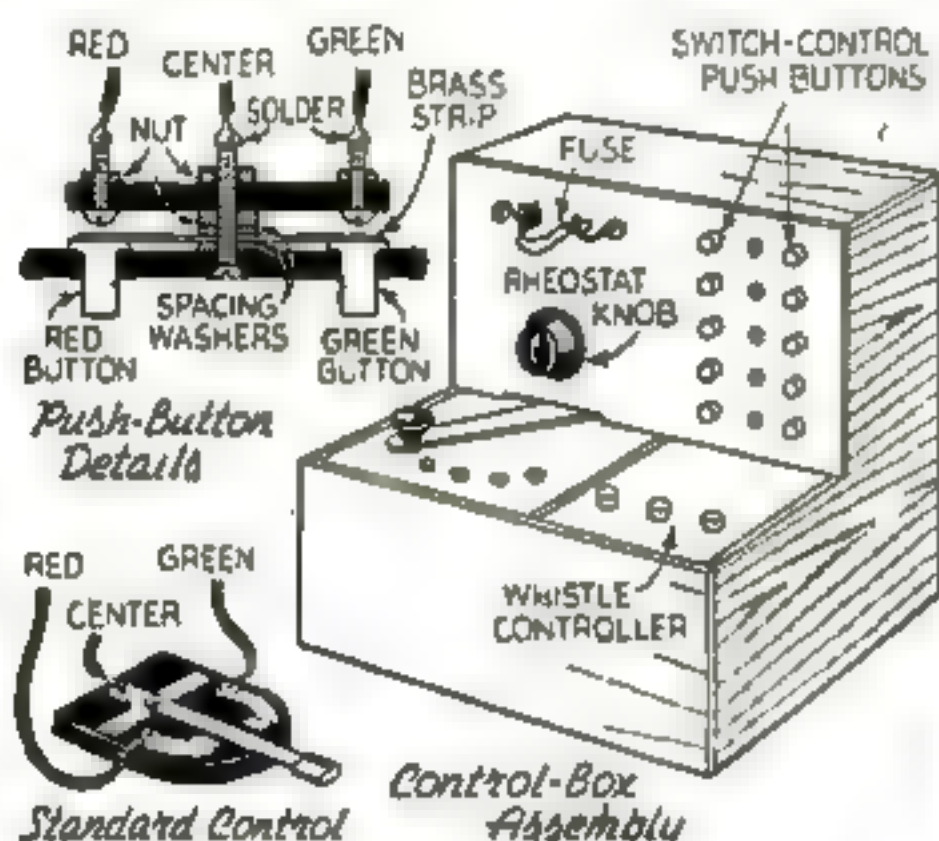
The entire turret should be painted a light gray, but the guns may be a trifle darker. The recoil cylinders and the windows in the "ears" are black. The deck may be finished with clear lacquer or white shellac, and it is suggested that the turret and base be painted separately. The interior may be of gray or some brighter color such as red or yellow.

CENTRAL CONTROL PANEL FOR MODEL RAILWAY

THE control apparatus for a good-sized model railroad system—transformer, rheostat, whistle controller, numerous switch controls, and possibly other items—looks much neater and is a great deal more convenient when grouped together and solidly fastened in a central unit of the type illustrated.

Any sort of light wood may be used for the cabinet, the dimensions of which are governed by the size of the apparatus.

A standard train rheostat may be mounted on the panel instead of the radio rheostat, although the latter is better looking. The rheostat should have a resistance of about 10



Switchboard and cabinet, and a detail of the compact type of homemade push-button control used in place of the standard ready-made unit

ohms and be of the power type, capable of carrying about 25 watts. The one used in the original model was taken from a 1924 storage-battery radio. The resistance coil was mounted on porcelain. The capacity was unknown, and undoubtedly somewhat less than 25 watts, but it is a sensible precaution to buy a rheostat of sufficient size to take care of equipment that may be added from time to time.

The fuse is a piece of lead foil or tin foil about 3 in. long by $\frac{3}{8}$ in. wide, fastened as shown under clips bent from a stiff wire. It is connected between one lead of the transformer and the track, to guard against extreme overloads and short circuits. The narrower the strip, the more easily the fuse will blow. It should be made approximately half again as wide as is necessary to take the full current of the system when the train is carrying full load and running at maximum speed.

The push buttons are used instead of the switch controls furnished with the set only because they are more compact.

The panel is mounted far enough forward in the box to cover the connections on transformer and whistle controller. Radio panel material is used; it is easily cut with a hack saw, and the edges smoothed with a mill file.—JOHN L. STORY.

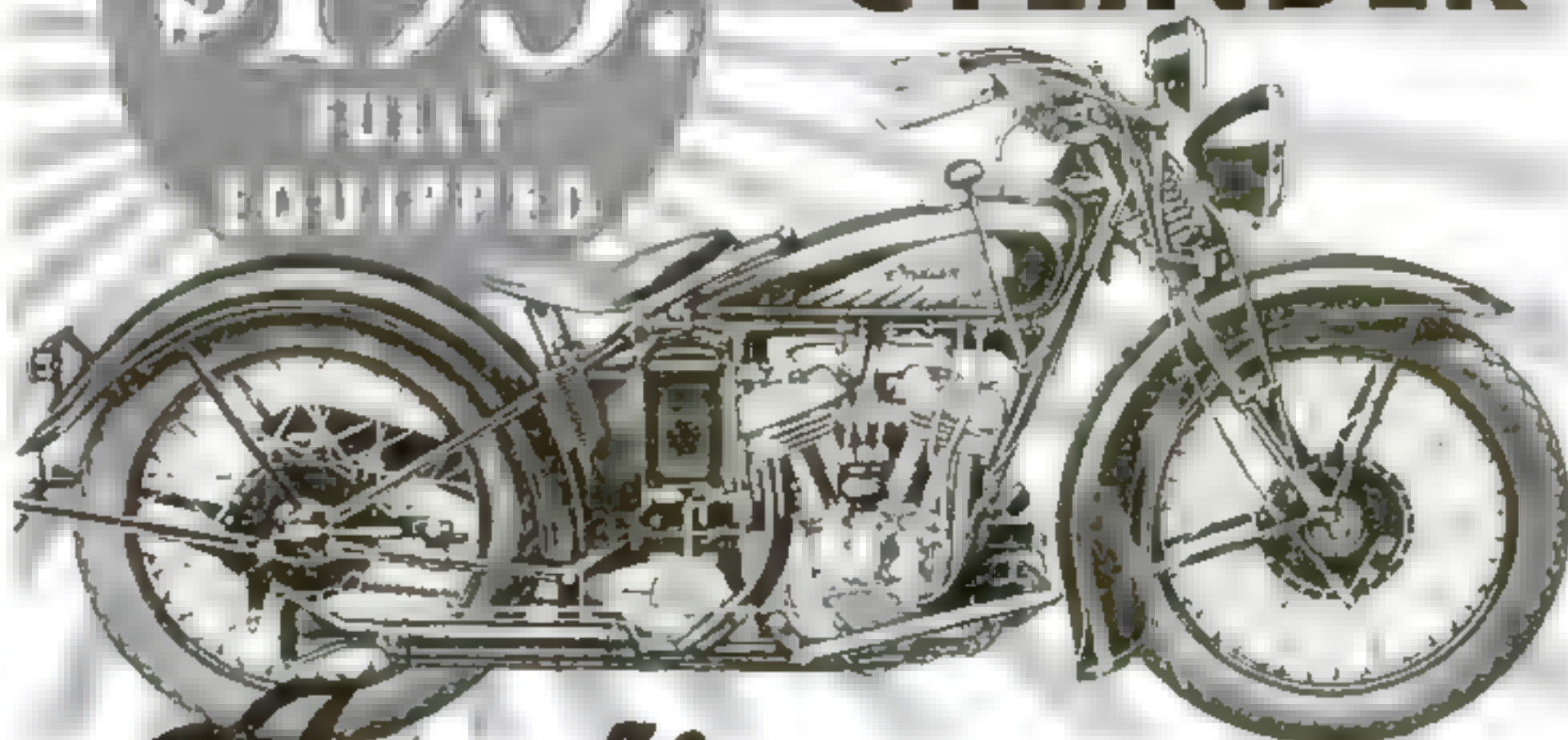
RAZOR HONE GIVES KEEN EDGE TO FINE WOODWORKING TOOLS

A TEN-CENT razor hone, which is nothing more than a very fine oilstone, will prove a valuable aid to the man who likes to give his woodworking tools the keenest possible edge. Sharpen the tools in the regular way, then give them a few strokes on the razor hone. This gives a razor-sharp, long-lasting edge suitable for the finest kinds of work.

The same type of razor hone can be made into handy little slip stones of special shapes, such as are needed for sharpening gouges, wood-carving tools, and the like. Just break the stone to an approximation of the desired shape, and bring it to final form on an ordinary bench grinder.—H.V.L.

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CYLINDER**



Indian JUNIOR SCOUT

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The new Indian Junior Scout is easy to handle—starts with the kick of the starter—packs plenty of power and pep to whizz you along up with the leaders. And it's as economical to run as it is to buy. You'll get 70 miles to the gallon easily.

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Address _____

Please be sure to check your age group:

☐ 16-19 years
☐ 20-30 years

☐ 31 years and up
☐ under 16 years

INDIAN MOTORCYCLE CO., Springfield, Mass.

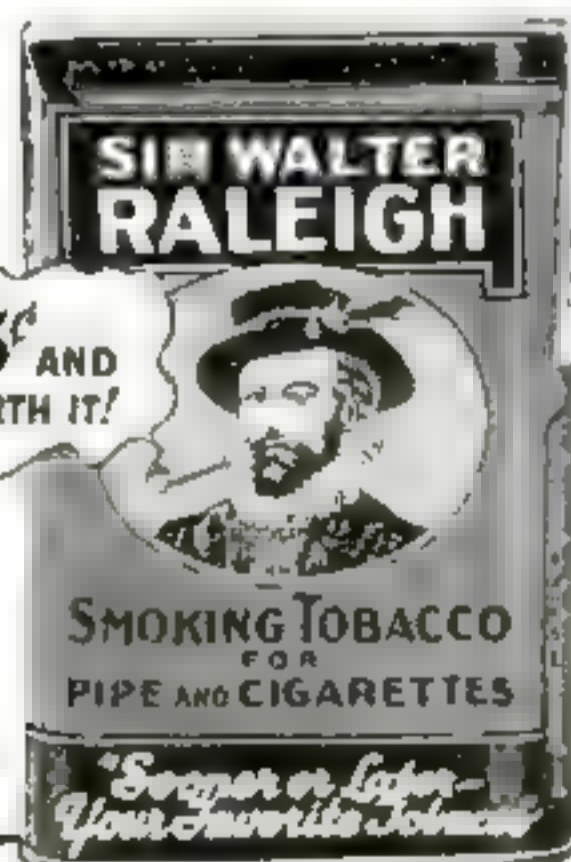
PIPE "BUSTS UP" HOME!



...then he switched to the brand of grand aroma



A GURGLY pipe stuffed with wife-strangling tobacco can wreck a love-nest. So keep your briar clean and tidy, reader; fill it only with Sir Walter Raleigh's fragrant, sweet-smelling mixture. Sir Walter is Burley, all Burley, Kentucky Burley. A supreme combination of leaf, easier on your tongue and the other half's nose. Well-aged, slow-burning, cool. And quite a bit milder: we've blended it for the man who wants to save his throat (as well as his sweetheart). Try it.



FREE booklet tells how to make your old pipe taste better, sweeten; how to break in a new pipe. Write for copy today. Brown & Williamson Tobacco Corporation, Louisville, Kentucky, Dept. Y-72.

HOW TO TAKE CARE of YOUR PIPE

TUNE IN JACK PEARL (BARON MUNCHHAUSEN) NBC BLUE NETWORK, MONDAYS 9:30 P. M., E. S. T.

REPLACING OLD LIGHTING FIXTURES

(Continued from page 82)

round surface type outlet boxes are not recommended for wall fixtures because the latter are usually supplied with very flat and shallow back plates, which allow so little space for the wire joints that a box at least 1½ in. deep is essential for proper installation.

The completed outlet with wires connected is illustrated in one of the photos. A switch-box bar has been placed across the box and secured with 6-32 screws. This has a ⅛-in. pipe-size tapped hole in the center, which receives a nipple for holding the fixture to the wall. One wire coming out of the box, it will be noted, has a band of white adhesive tape wrapped on it. This was found after testing to be the grounded conductor and connects, as re-



How the gas-pipe plug is set and tightened



quired by the "Code," to the outside or shell side of the socket. The white or tracer-marked fixture wire is usually the one in every fixture

that connects to the outside socket terminal, so this white fixture wire connects to the white banded outlet wire as shown.

The method of testing wires of unknown polarity to find the grounded conductor is given in one of the sketches. In modern wiring systems, wires with different colored insulation coverings are used to identify grounded and ungrounded wires. To test for polarity, a socket with a lamp and two wires is used as shown. Any gas, water pipe, or other grounded object may be used for one contact. If the switch box itself is touched by the gas pipe at the back or otherwise, it can be used for the test. With the power on the wires under test, touch one test lamp wire to the gas pipe and the other to each outlet wire. The one from which no light can be obtained is the grounded conductor and should be marked as previously explained, and the power shut off.

When the grounded wire has been connected, the other or live wire is connected to one wire from the switch, and the other switch wire attaches to the other socket wire, thus completing the circuit. Be sure to solder all joints after thoroughly cleaning the copper ends by scraping with a knife, and twisting them up tightly. Both rubber and friction tapes should be applied over the soldered joints.

In the photograph of the completely installed sconce, note how tightly it fits against the wall because of the generous space provided by the switch box for the joints. A decorative flame-type lamp and "drip" candle slip carry out the pleasing effect. Note the knob in the center that screws on the nipple, clamping the fixture tightly; also the tiny "pin" switch just below that controls the lamp. As a safety measure, have all electrical work inspected by local authorities when completed.—HAROLD P. STRAND.

REMOVING BROKEN KEY FROM LOCK IN DOOR

IN THE cheaper grades of mortise locks, the key will sometimes snap off in the lock when an attempt is made to open the door. Inexperienced or careless workmen often chisel free the keeper plate in the door jamb to enable the door to be opened. This is a poor method because it leaves a botched job, to say nothing of the time and trouble required in patching the wood and matching the finish. The following method leaves the door and trim in its original condition, with no patching to be done.

First, remove the door knob and the escutcheon plate. Then remove as much wood as possible from around the keyhole without showing the loss when the escutcheon plate is later replaced. Drill a series of holes in the lock casing you have exposed. If the casing is cast iron, the holes may be spaced a little apart and the encircled section snapped out with a smart rap by using a nail set or a punch. If the casing is sheet metal, the holes will have to lap each other in order to remove this section. This exposes more or less of the inside of the lock, and usually it is possible to grasp the broken key with a pair of slim pliers and throw back the bolt of the lock. The bolt was probably

binding on the keeper plate and that caused the key to break; therefore, when throwing the bolt back, gently pry the door up and down with a wide chisel placed between door and frame, sill, or head, depending on the direction of the trouble. If the key cannot be grasped, you may be able to raise the lever tumblers and force the bolt back.

Even if it is necessary to spoil the lock completely, it will be found cheaper to replace the lock with a new one than to chisel the keeper plate free and patch the jamb.

Before the job is completed, the cause of the bolt's jamming should be found and eliminated.—R. L.



Drilling holes so lock parts can be exposed

REPAIRING FIREPLACE

(Continued from page 82)

smoking, the wind shelf probably needs cleaning. This shelf is at the bottom of the chimney, just above the throat. Its job is to catch descending currents of air and turn them back so they go up with the ascending current from the fire below. When the shelf gets piled full of soot, the air slides right down over the pile and on down into the fireplace, where it drives smoke out into the room.

To get at the shelf, first remove the movable damper leaf. It is fastened to the damper control rod by some device, usually a cotter key. Take out the key and unhook the control from it. Now tip one end up the chimney and remove the leaf down through the throat. The wind shelf then may easily be reached for cleaning. A good time to do this job is right after a rain when the soot is moist. If it is dry, wet it down before trying to remove it. Using an old scraper or a piece of stiff metal, scrape all soot and ashes from the shelf and let it fall on papers spread out in the fire box.—D. C. MARSHALL.

ANVIL MAKES FIRM BASE FOR BENDING JIGS

AS A RULE the shop anvil is so securely placed that it makes an ideal base for light bending jobs for which there is no special equipment. For applying horizontal pressure in bending light rods and for other



A section of channel steel is bolted on the anvil to hold a variety of bending fixtures

similar uses, a section of channel steel, bolted through the anvil hole, forms a solid anchorage for the necessary bending devices. Select a channel the flanges of which closely hug the sides of the anvil as illustrated to prevent any side movement.—JOSEPH C. COYLE.

TURNING A BUFFET SET

(Continued from page 80)

base with a carpenter's chisel as previously explained.

Assembly. Return the improvised chuck with the bowl attached to the head of the lathe. Put a little glue on each side of one of the white holly squares laid aside with the pedestal; then slip the square over the dowel on the upper end of the pedestal. Glue the dowel into the bowl. Repeat the procedure for the base.

Remove the cup center from the tailstock of the lathe and screw the shank of the tailstock into the faceplate opening on the base. Take the set screw from the faceplate so that the plate can revolve on dead center. Oil the shank to keep it from heating.

With a spear-point chisel, shape the holly rings. To clean the walnut dust from the various rings of white holly, use very fine sandpaper. Sand only the holly and be careful not to touch the walnut.

Finish the base and pedestal in the usual way with shellac and a little oil applied with a pad as in French polishing.

The candleholders. These are exactly the same dimensions as the base and the pedestal of the bowl and are made in the same manner, except that there are no white holly rings at the top of the sticks. Before the turning of the sticks is begun, drill a $\frac{7}{8}$ -in. hole to a depth of 1 in. in the top end of the stick. This hole must be centered.

Place a $\frac{7}{8}$ -in. white pine dowel in the hole. Put the stick in the lathe with the dowel at dead center of the lathe. Turn to shape as in Figs. 3, 4, and 5. Finish with shellac and oil.

The candles. Two pieces of white pine, 1 by 1 by 12 in., are used in turning the candles. Drill a $\frac{1}{16}$ -in. hole $\frac{1}{4}$ -in. deep in the end of each for the wick. When in the lathe, these holes should be at dead center. Turn to shape as in Fig. 6. Use heavy cord for the wicks, gluing them into the end holes of the candles. Coat with two applications of white enamel. When dry, apply lacquer to about 6 in. of the center of each stick and dust with gilt.

Finish. All pieces with the exception of the candles should be given several applications of floor wax and polished with soft cloth after each application until the desired high polish is obtained.

American Industries Use Delta Tools

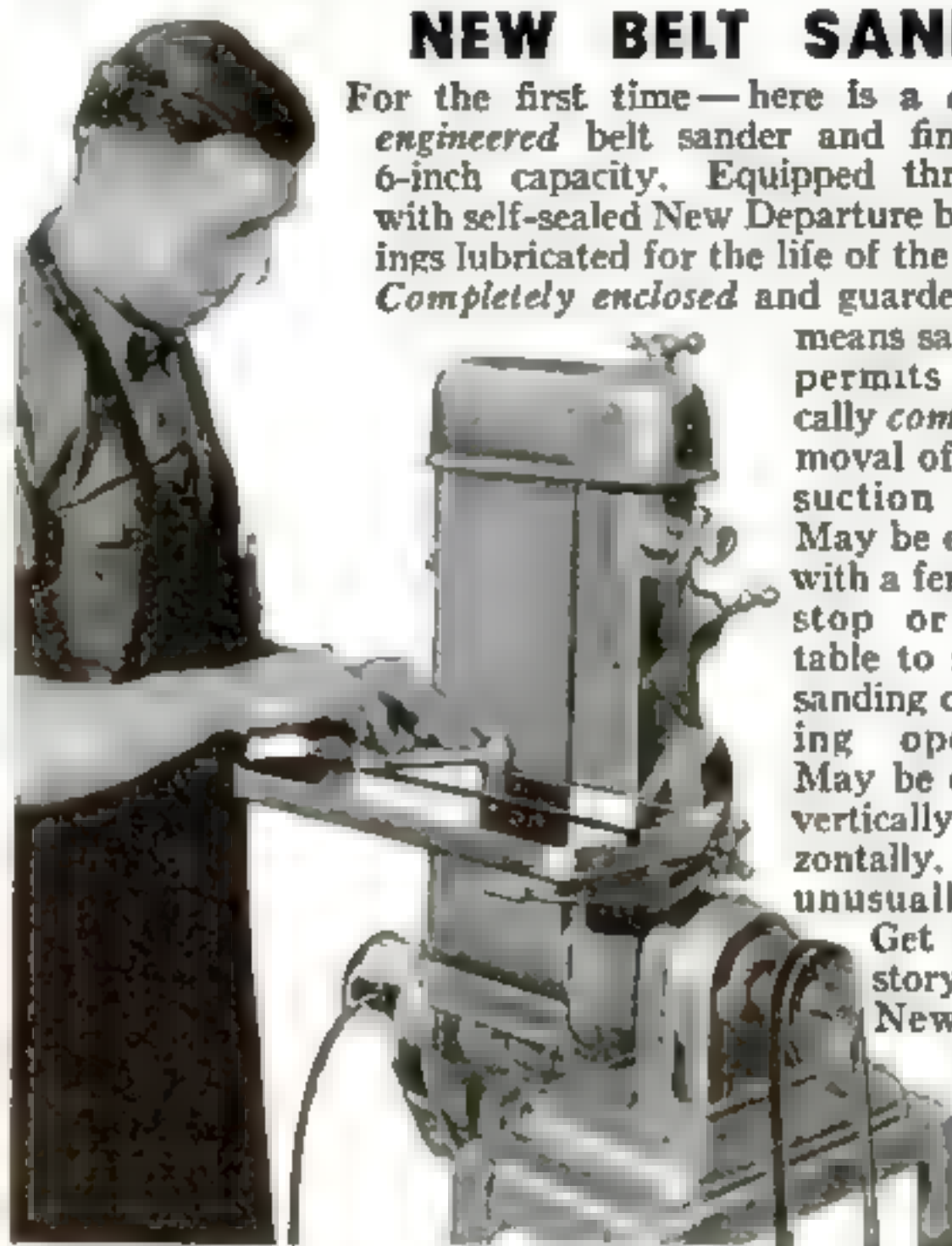
You take no chances when you buy Delta tools. These machines have proved their worth in thousands of toolrooms, machine shops, production lines and industrial shops of all types and size. You will find that there are more Delta tools used in industry than any tools of the same type made by all other makers combined. Read the roll call of Delta users. It speaks for itself!

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For the first time—here is a *correctly engineered* belt sander and finisher of 6-inch capacity. Equipped throughout with self-sealed New Departure ball bearings lubricated for the life of the bearing. *Completely enclosed and guarded* which

means safety and permits practically *complete* removal of dust by suction system. May be equipped with a fence, back stop or tilting table to suit any sanding or finishing operation. May be operated vertically or horizontally. Priced unusually low.

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It is crowded with interesting illustrations and descriptions of the complete Delta line. Points out in detail the important features of Delta design. And also the new 32-page book No. 3 of "Practical Delta Projects" crowded with new and "out of the ordinary" things to make—with many photographs, working drawings, and easy-to-understand illustrations. Simple, complete instructions make every project easy to follow. Every craftsman should have this book. Send 10c with coupon for Delta Project Book No. 3. 1937 Delta catalog mailed postpaid.

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Hudson Motor
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Fisher Body
Continental Motors
Packard Motor Car Co.
Chrysler Corporation
U. S. Rubber Products, Inc.
Fairbanks-Morse Company
Itasca Accessories Mfg. Co.
Republic Steel Corporation
Graybar Electric Company
Trucon Steel Company
Firestone Tire & Rubber Co.
Mallinckrodt Chemical Co.
International Shoe Company
Caterpillar Tractor Company
The H. F. Goodrich Company
Goodyear Tire & Rubber Co.
Pittsburgh Plate Glass Co.
United Air Lines Trans. Corp.
Rord Piston Ring Company
Allis Chalmers Company
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No matter how long you own your passenger car—no matter how far you drive it—if the Goodrich Kathanode Electro-Pak you buy for it fails to give satisfactory service in that car, The B. F. Goodrich Company will replace it without charge, as clearly stated in the written guarantee.



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And that's possible. In an actual road test, certified by Western Union, the Goodrich Kathanode Electro-Pak pulled a 3150-lb. car 1836 feet in low gear and on battery power alone!



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THE ONLY BATTERY WITH THIS POWER-SAVING TOP COVER

This exclusive Top Cover shields all exposed points—protects against acid spray, dirt, corrosion, short circuits. It keeps Electro-Pak's extra power locked in. Get one today at your Goodrich Tire and Battery dealer's.

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HOLLYWOOD IMPROVES ON NATURE

(Continued from page 50)

Direction of large mob scenes on these far-flung locations requires up-to-the-minute scientific aids. For example, no man shouting through a loudspeaker system could bring three columns of movie soldiers, scattered over a three-mile radius, into the range of the cameras together; but radio turns the trick.

During the filming of a movie battle recently, 500 defending soldiers awaited a scheduled attack. Hidden from the cameras, an equal number of the "enemy" waited for the call to advance. At last, cameramen and sound technicians reported ready, and the director turned to the radio operator, sitting at his portable equipment near-by.

"Call for action," he ordered.

Into the high-frequency transceiver, a combination speaking and listening unit which permits two-way conversation, the operator poured forth commands:

"ONE hundred men in Unit 1 advance. Unit Leader 2, count ten seconds and bring his men into the valley. Units 3, 4, and 5, follow five seconds later. O.K., boys, let her go."

As the director spoke, five cameras began to roll. Two took in a broad sweep of the panorama, showing the "enemy" coming down out of the hills, while the others grabbed close-ups of individual columns through telephoto lenses.

Here and there, in the valley, hidden by swirling dust, small groups fell behind. From each, a leader descended and bent low over a pit dug in the earth. In each pit had been placed a short-wave radio receiving set. As the battle raged, the director again called for these stragglers to rush into the fray.

In filming scenes in snow, each day brings a new battle with nature. A director completed a set late one afternoon, intending to start shooting the following morning; when he looked out from his bunk house next day, the set had virtually disappeared under a heavy snowfall. Five weeks elapsed before the actors could use the set as a background.

Under combined conditions of altitude and forest, particularly in snow, the camera can work only one hour in a day. Since snow may fall between scenes, obliterating much of the scenery, it becomes the responsibility of the film cutter in Hollywood to match shots so that the public is unaware of the deception.

Nature sometimes cracks down on film companies with a vengeance. The cameramen and technicians who went into the Idaho forests, expecting to finish their jobs and return to Hollywood within four weeks, were still there three months later, laboring to get the picture "in the can." For eight weeks they were marooned, 100 miles from Lewiston. A dog team brought them fresh milk and mail once a week, over a 100-mile snow-covered trail. Three locomotives which had drawn their train into the woods were snow-bound, but the company was assured a meat supply by a small flock of sheep, which had been carried in to guard against just such an emergency.

ONE director recently called for the immediate filming of scenes showing an airport in the desert. Since time did not permit the company to travel a long distance, the company moved to a flying field in the San Fernando Valley, north of Hollywood, where they found a range of hills facing the cameras. Here the special-effects expert not only obliterated the hills by throwing up a smoke screen of neutral color which did not photograph, but also produced fog as a background for close-up scenes. Cameras ground out the sequence, only to have the director order

"cut" when an actress complained of the odor of the fog.

Ten minutes later, the cameras were turning once more and the actress who had expressed displeasure at the noisome fumes went through her part breathing an orange-scented fog. Special-effects workers had discovered, when experimenting in the studio laboratory, that they can go nature one better by creating fogs of any scent. They have produced lemon, sassafras, and orange fogs for several recent pictures. An ingenious machine produces white or black smoke or fog, and damp or dry mists, by spraying varying amounts and kinds of oil, or bubbling air through chemicals.

WHENEVER a script calls for scenes beside or under the sea, property men know they must "piece out" nature with anything from scattered grass to hundreds of artificial palm trees. Sheltered beaches on Santa Catalina Islands have appeared in more pictures of the sea than any other setting, and have represented nearly every tropical island ever filmed. Almost overnight, studio carpenters "plant" papier-mâché palms whose leaves wave realistically in the breezes, build high prows on ancient sailing vessels, and construct war canoes so that Hollywood extras may become man-eaters of the South Seas among what appear to be natural surroundings.

Off the Catalina coast, too, divers often have crawled around the sunken wrecks of windjammers, planted from barges so that their rotting hulls might face the sun and reflect all the light possible. Were it not for ingenious cameramen and their devices, such scenes could not be filmed.

Ordinarily, no lights are used in these undersea shots. The other day, a cameraman descended in a darkened diving bell, his camera looking out through a square of glass. Suspended from a series of ropes, metallic reflectors cast sunlight on a sunken ship, while eerie shadows played across the waving grasses—stalks of green celluloid attached to weights which caused them to stand upright. In itself, the scene would have revealed only a stretch of sand, with a helmeted actor moving easily toward the gaping hole in the wrecked ship; by the aid of the weighted grass and light, the camera caught the illusion of a diver exploring the sea bottom near a tropical isle.

Under proper conditions, a movie camera can see 200 feet through sea water. Only nearby objects are in sharp focus, however, and only in the rarest cases can underwater action be photographed without the aid of lights. To overcome this problem, one cameraman devised a diving bell in which he descends. He sits in a saddle, his legs dangling in the water beneath. When he reaches the bottom, he walks along the rocks or sand, under the bell, and directs the placing of the reflector by telephone. Within his dark air bubble he can swing his camera in any direction, catching whatever action may develop.

NATURE is more exacting in her demands for undersea photography than for surface scenes. Whenever a script calls for a scene to be played, say, 100 feet below the waves, the camera is placed twenty-two feet down, to avoid reflections from waves. Oddly, the cameraman finds more difficulty in excluding things not wanted than in photographing the scene itself.

Many of these difficult scenes could be filmed in miniature, on sound stages, or in tanks of water. But the movie producers are trying for realism these days, and chances are the complicated outdoor stunts you see at your theatre really were photographed outdoors.

MODEL RIVERS SHOW WAY TO FLOOD CONTROL

(Continued from page 31)

a battery of manometer tubes, in which the height of the liquid column in each tube represents the pressure at the point in the model from which the tube leads.

Sometimes it is necessary to know how the water is moving in different parts of a column or stream. To show this, the currents are made visible by introducing streams of a dye such as potassium permanganate into the water. The colored streaks can be observed and photographed. One problem that was worked out with the aid of dye was the proper design of a concrete corner around which water must flow to pass over a dam.

ANOTHER interesting model shows the Tygart River Dam, the first flood-control dam for the Pittsburgh region. It is a vertical section of the dam in the direction parallel to the water flow. Heavy glass walls enable the action of the water to be seen and photographed, as it rushes down the dam and strikes the "cushion pool" at a velocity of sixty-seven miles an hour. The engineers are trying to determine, from model studies, whether the bottom of the cushion pool should be paved to check erosion.

Nowhere else in the world can there be found a research set-up like that in another building of the Carnegie Institute group. Here hydraulics experts are learning, with the aid of an unusual machine, why the outlet conduits of so many dams fail, and how such failure can be prevented.

Water rushing through a concrete tunnel at high velocity sometimes attacks the tunnel, usually at a point near its entrance, and tears the concrete away. The reason for this is that a vacuum is formed between the water and the walls of the concrete. This vacuum builds up and collapses, perhaps several thousand times a minute, subjecting the concrete to a hammering action that causes it to wear away and form cavities.

To find out how this can be prevented, a machine in which water is circulated through a scale model of a conduit under vacuum was assembled. A centrifugal pump circulates the water, and a vacuum pump lowers the pressure in the system. The model conduit, made of concrete and mounted beneath a window of high-strength glass, is one fifteenth normal size, and the pressure and water velocity are regulated proportionately.

With this machine, ways of preventing cavitation of concrete tunnels were found. It simply is a matter of shaping the entrance of the tunnel properly. One of the concrete test blocks, when placed in the machine, will wear rapidly in a short time, while another will show no wear at all. The reason lies in the shape of the curved entrance; and the variation between the curves of the two models may be difficult for the unskilled eye to see.

IN ADDITION to research work on Government problems dealing with water flow, the Hydraulics Laboratory does important work in other directions. Various power companies, whose properties include dams either in existence or projected, take their hydraulics troubles to the laboratory. Once the laboratory constructed a portable model of the Buckhannon Dam on the Colorado River of Texas, for use in a suit before the United States Supreme Court.

To the casual visitor, the Hydraulics Laboratory at Carnegie Institute of Technology may seem a place where men amuse themselves by building playground rivers on which to sail toy boats, and making model dams just to watch the water rush over them. But, in reality, it is a place where damage and disaster are headed off with the aid of scientific scale models.

Half & Half Makes ONE Swell Smoke!



No Bite!

No Bite!

Still no Bite!

Not a bit of bite in the tobacco or the Telescope Tin, which gets smaller and smaller as you use up the tobacco. No bitten fingers as you reach for a load, even the last one.

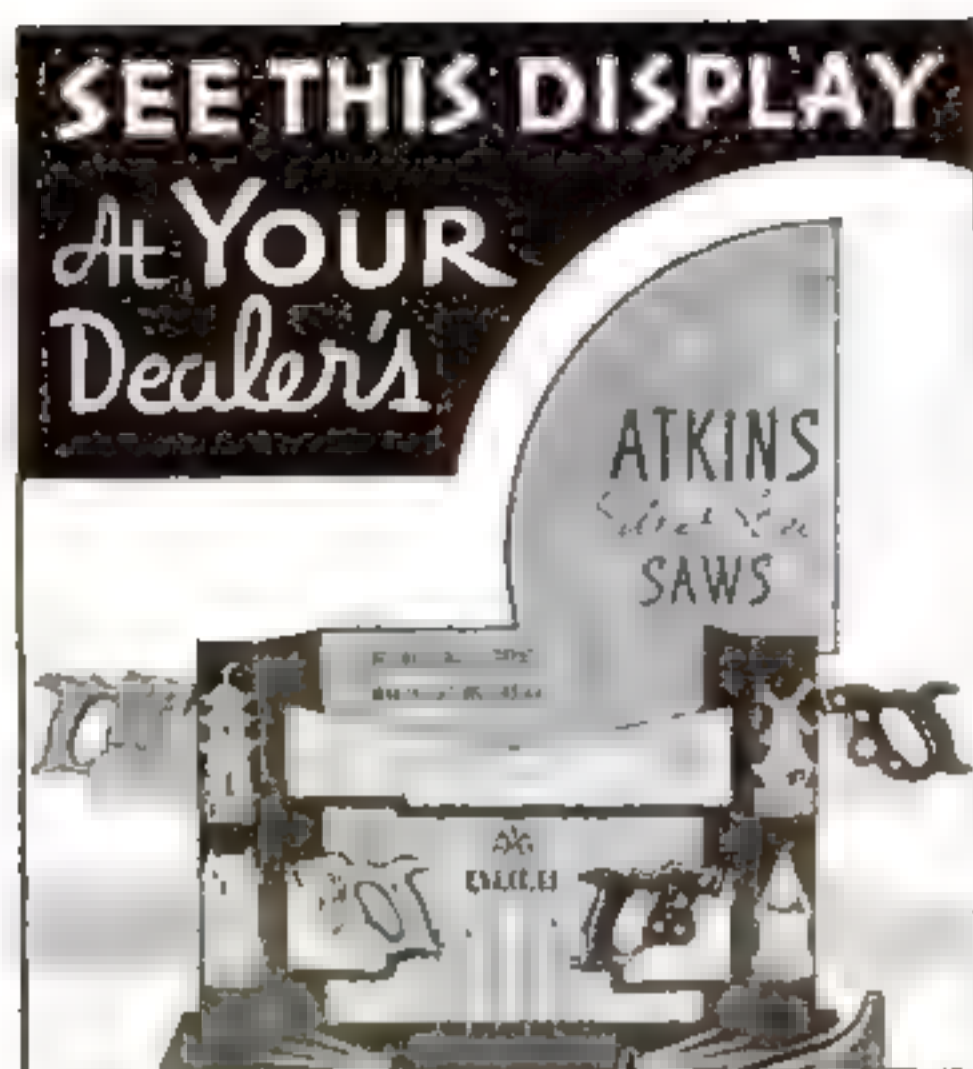
Your pipe will bat a thousand with Half & Half. Cool as two strikes with three men on base. Smooth as the hit that brings in four runs. Fragrant, friendly, full-bodied tobacco that won't bite the tongue—in a tin that won't bite the fingers. Made by our exclusive modern process including patent No. 1,770,920. Cool and smooth. Smells good. Makes your pipe welcome anywhere. Tastes good. Your password to pleasure!

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Illustrated to the right, above, is the popular Atkins "Silver Steel" No. 65 Ship Point Hand Saw with Perfection Handle, 26" length—at YOUR Dealer's for \$3.45. The display also shows Atkins "Silver Steel" No. 401 Hand Saw, the Elite of all saws for Craftsmen, 26" length at \$5.75; Atkins "Silver Steel" No. 51 Hand Saw at \$3.45; Atkins No. 59 Hand Saw at \$2.25; Compass Saws; No. 3 Nest of Saws; Trowels and Files. Be sure to know about Atkins Saws and Tools BEFORE you buy.

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E. C. ATKINS & COMPANY

428 S. Illinois St., Indianapolis, Ind.

APPLYING ENAMEL THE MODERN WAY

(Continued from page 81)

and dust. Pay particular attention to the lower corners of panels.

Now let us study the series of photos so that operations may proceed in their natural sequence. Whether the work involves the trim on a French door and bookcase ensemble, a fireplace panel with mantelpiece, or the wider and more involved handling of large panels, the procedure remains practically the same.

In the first operation on panel work (Fig. 1), a narrow brush is used to run the panel line itself so that the small square or molded



Starting to cut in a molded panel on a fireplace. Incidentally, the bricks were cleaned with a trisodium-phosphate washing powder

edge is freely covered with enamel, working from each corner toward the center of each side and end, when the brush is lifted off and redipped in enamel. When dipping the brush, immerse the bristles not more than an inch and "spat" the brush against the inside face of the half-full container to distribute the enamel evenly through the bristles and to remove any excess. Do not work directly from a full new can and do not wipe or drag the bristles over the edges of the can. This removes too much material from the brush and causes dripping on the outside of the can.

Now change to a 2- or even a 3-in. brush, dip it in the enamel, "spat" it against the container, and then apply quickly with X-brush strokes, as in Fig. 2, repeating until the entire panel is covered.

With a single drawing stroke from ferrule to bristle tip, wipe the brush almost dry on each side over the edge of the can and then use the tips of the bristles only to quickly "tip off" the entire panel (Fig. 3), working from the top halfway down and from the bottom halfway up, when the brush is lifted off.

Now coat in the bottom cross rail and then the top, working from left and right to the center in each case. Notice throughout that all brushings must be done from all corners and not toward them, or the enamel will be dragged out of the brush and start a bad sag or drip down from the corners.

Finally, change to a narrow brush and cut in the stiles of the panel in such a manner that the brush quickly but lightly crosses the ends of the top and bottom rails, thereby giving a

clean-cut effect where the joint between rails and stile would naturally occur.

Avoid back tracking or touching up. Rather wait until the new surface has properly hardened, then sand, dust, and tack off, and in the case of a panel, coat in entirely. Never try to patch a panel.

At no time must there be any amount of heavy and vigorous brushwork such as is required in outside painting. Rather the light, quick, and easy freedom typical of good varnish work is what is necessary. The beginner will do well to start in the least noticeable section of the room. In this manner he can learn how the material works, how much it can be brushed, how little is needed to get easy coverage, and most important of all, how quickly it sets.

FOR successful work a temperature of 70-75 deg. F. is about right, while the wet bulb should be around 10 deg. less for ideal conditions. As a matter of practice, these conditions are not as easily controlled in the home as might be desired, but the heat can be and should be kept as indicated whenever possible. Ventilation should be arranged so that a free flow of clean air is available constantly. For this reason enamel work should really be done whenever possible during the summer months. In the winter months, keep the room closed and quite warm until the enamel has "set"—about an hour—then open the windows top and bottom about an inch so that free circulation may be had, but without drafts, which might cause the enamel to chill and subsequently wrinkle.

Avoid any inside paintwork, including varnishing and enameling, during the extremely hot, humid weeks of midsummer, or the materials may remain sticky and collect dust for a considerable period.

Brushes which have been used in enamel should be thoroughly rinsed in turpentine. Work the bristles carefully to remove all enamel from the heel of the brush. They should then be rinsed again in clean turpentine and suspended in a varnish brush keeper reserved for enamel brushes alone. Keeping the brushes immersed in varnish in this way maintains the elasticity of the bristles and insures their being ready at all times to do a fine, clean piece of finishing. Without this care brushes inevitably get "seedy" in the heel and as a result spread tiny lumps or specks of material in the new enamel film.

Considerable experience has proved that a roll of red, rosin-sized building paper may be used to advantage for cutting strips to cover the floor, rather than cloth. This paper is heavy enough to withstand stepladders and sawhorses. It keeps spots from going through and staining the floor, and best of all does not contribute lint to float around the room and settle on the fresh enamel or paint.

A suggestion as to the type of enamel best suited to your needs: If the woodwork is newly erected and freshly sanded, it should be primed with a coat of half floor varnish and half turpentine. Under no circumstances use shellac, which while fast drying is too brittle and affords too little adhesion to both the wood and enamel to be durable after the first year. The varnish primer is tough and long-lived. For the second coat, use equal parts of enamel and undercoater, followed by two coats of finish enamel as furnished in the can. The last coat can be rubbed dull with FFF pumice stone and water, wiped clean, and oil polished with old cloths.

For used woodwork or where rubbing is too laborious or expensive, use an eggshell enamel final coat. Because of its lack of excessive gloss it does not show up dents and other minor imperfections.

Bows That Bend Perfectly Made with Aid of Chart

EVERY archer who makes his own bows will appreciate this simple method of testing the curve. From prehistoric times it has been customary to test or "tiller" new bows by eye and scrape them down until they looked to be correctly curved when fully drawn. Recently, however, Jack Hazard developed a diagram for a flat bow (*P.S.M.*, Aug. '36, p. 94), and now V. B. Leonard, of San Angelo, Texas, has worked out a formula for any bow of ordinary length.

BY THE method to be described it is possible to determine the correct curve for a bow and plot it for tillering purposes—that is, for drawing up and testing a bow during the final and most important part of the shaping process. The plot will apply to any bows falling within these specifications:

Length	Riser	Draw
5 ft. 6 in. to 5 ft. 10 in.	7 in.	28 in.
5 ft. 2 in. to 5 ft. 6 in.	6 in.	26 in.
4 ft. 8 in. to 5 ft.	5 in.	24 in.

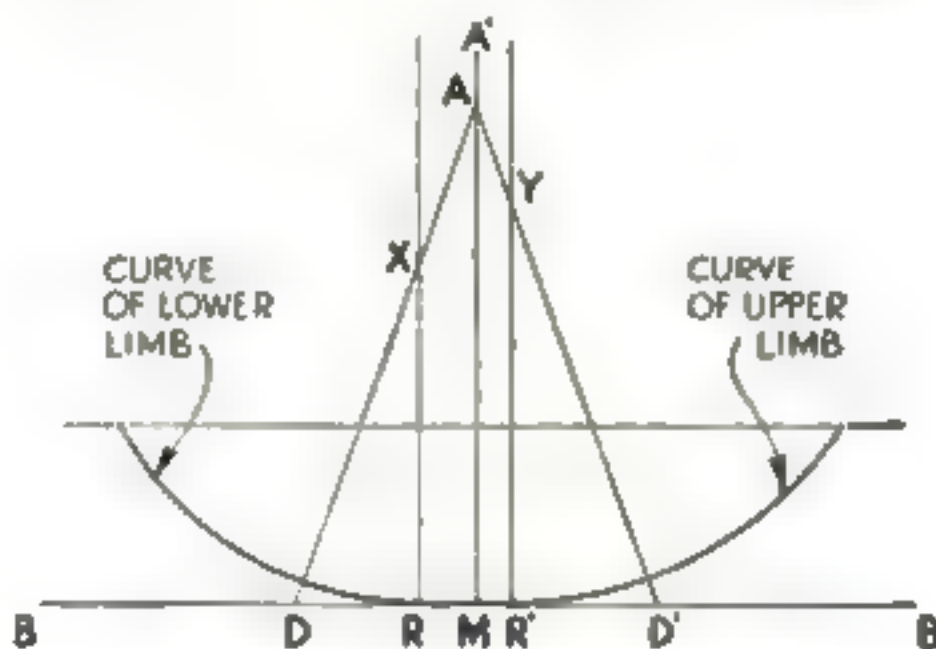
The riser is the handle and dead part complete. The dimensions suggested for the risers approximate closely those laid down by C. N. Hickman in his recent archery research work. The plot is so devised that as much as 2 in. may be added to the riser without affecting its accuracy. The full 6-ft. bow may be plotted in the same manner if it is borne in mind that there will be 1 in. on each end of the bow for nocks.

The method of laying out the grip is that used by Howard Hill. The middle of the bow is $1\frac{1}{8}$ in. from the top of the grip and $2\frac{7}{8}$ in. from the bottom, 4 in. over all. To

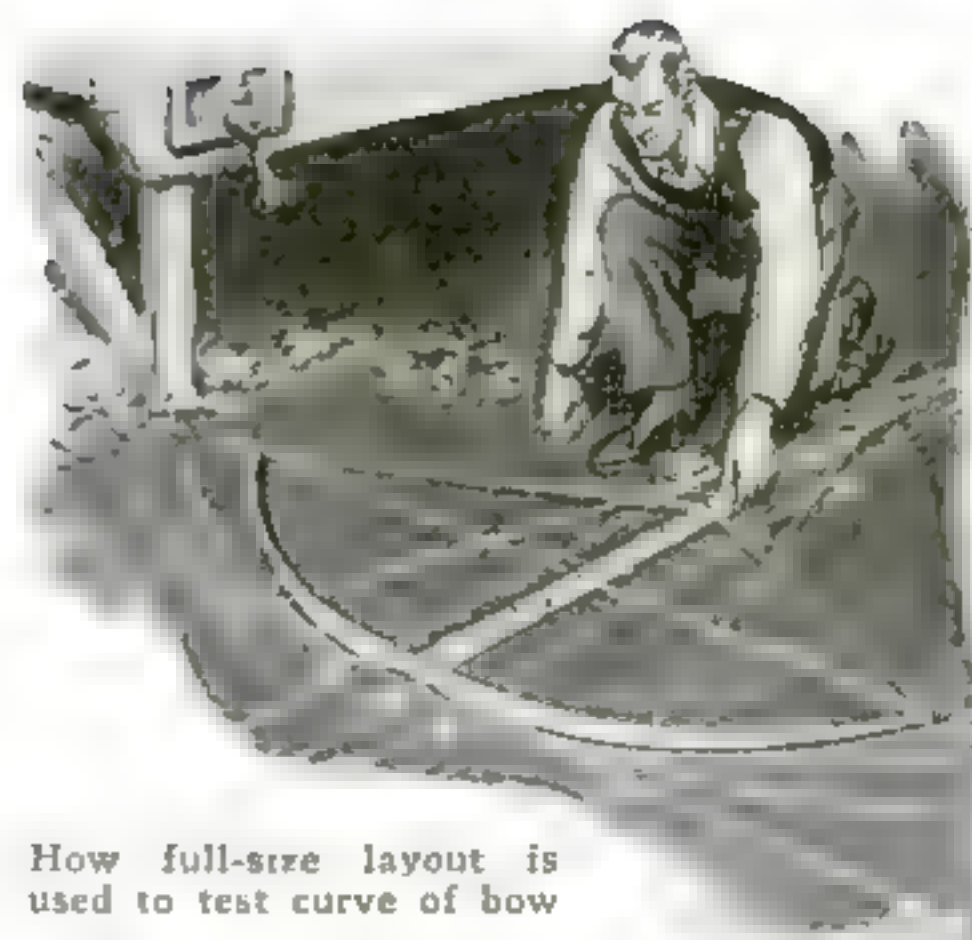
lay out the riser, add one half of the balance of the dead part to each end of the grip.

To construct the plot, draw a line (BB') approximating the length of the bow. Draw another line parallel to it and exactly one half the length of the draw above it. On BB' mark M , the middle. From there lay off the riser as just explained. Again from M measure each way one half the length of the draw. Mark the ends of the riser R, R' and the points at one half the draw D, D' . At M erect a perpendicular MA' . Draw parallels to this from R and R' . To determine the altitude or distance MA of the triangle ADD' , add the length of the bow (L) to twice the draw ($2D$), subtract the length of the riser (R), and divide the result by three. It is easier to understand as an equation:

$$\frac{L + 2D - R}{3} = A \text{ (altitude of triangle)}$$



Although easy to draw, this diagram solves the most baffling problem in making a bow



How full-size layout is used to test curve of bow

When this is determined, lay off this distance upon the vertical MA' . Mark this point A . From the points D and D' draw lines to A . These will intersect the two verticals (R and R') at unknown distances (X and Y). With Y as a center and YR' as a radius, draw a curve until it intersects the line above BB' . This will be the curve of the upper limb. Do the same at X for the lower limb. You will note that the radius for the lower limb is shorter; so also is the working part of the lower limb shorter. By measuring around the curve from M either way you will find it to be one half the bow, allowing for nocks.

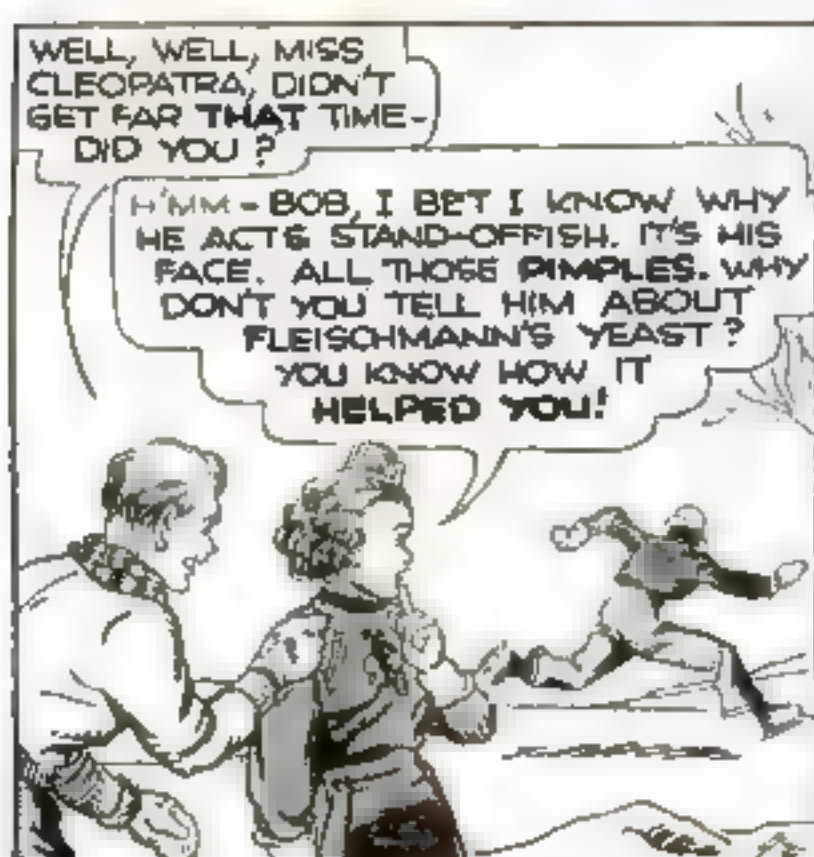
When the plot is completed, lengthen each radius 4 in. and with the point of the radius in the R and R' verticals, draw another curve for each limb. This will give a much broader curve. If repeated twice more, this will provide an excellent series of three approach curves that will be of much assistance in the earlier stages of the tillering process. It will prevent weakening a limb in one spot more than necessary.—V. B. LEONARD.

YOU HAVEN'T A CHANCE, SIS JIM HATES GIRLS!



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FACE
MADE
HIM
BALKY
ABOUT
GOING
PLACES

➔
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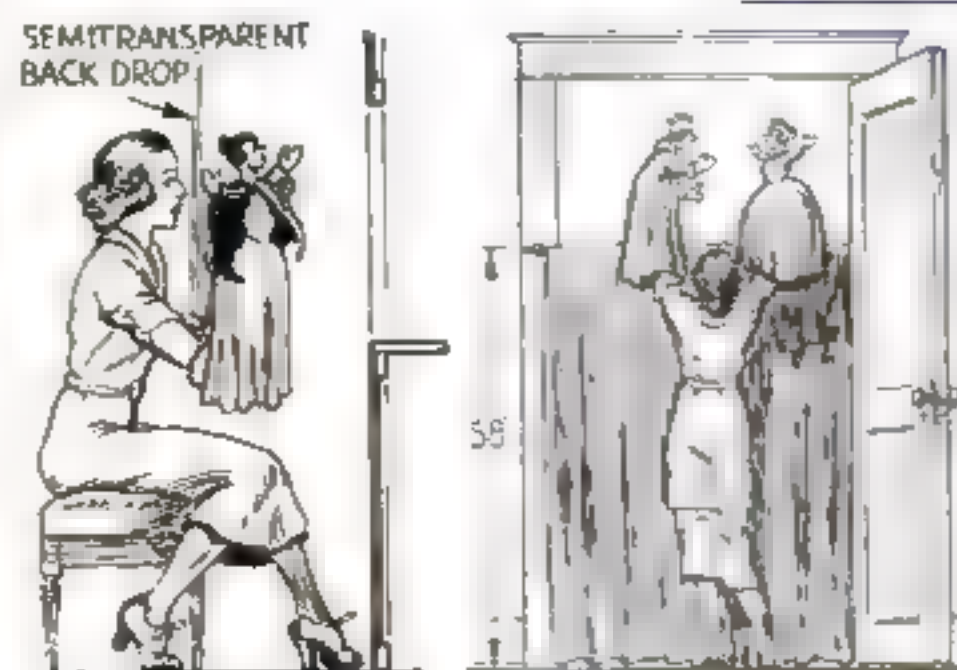
Occupation.....

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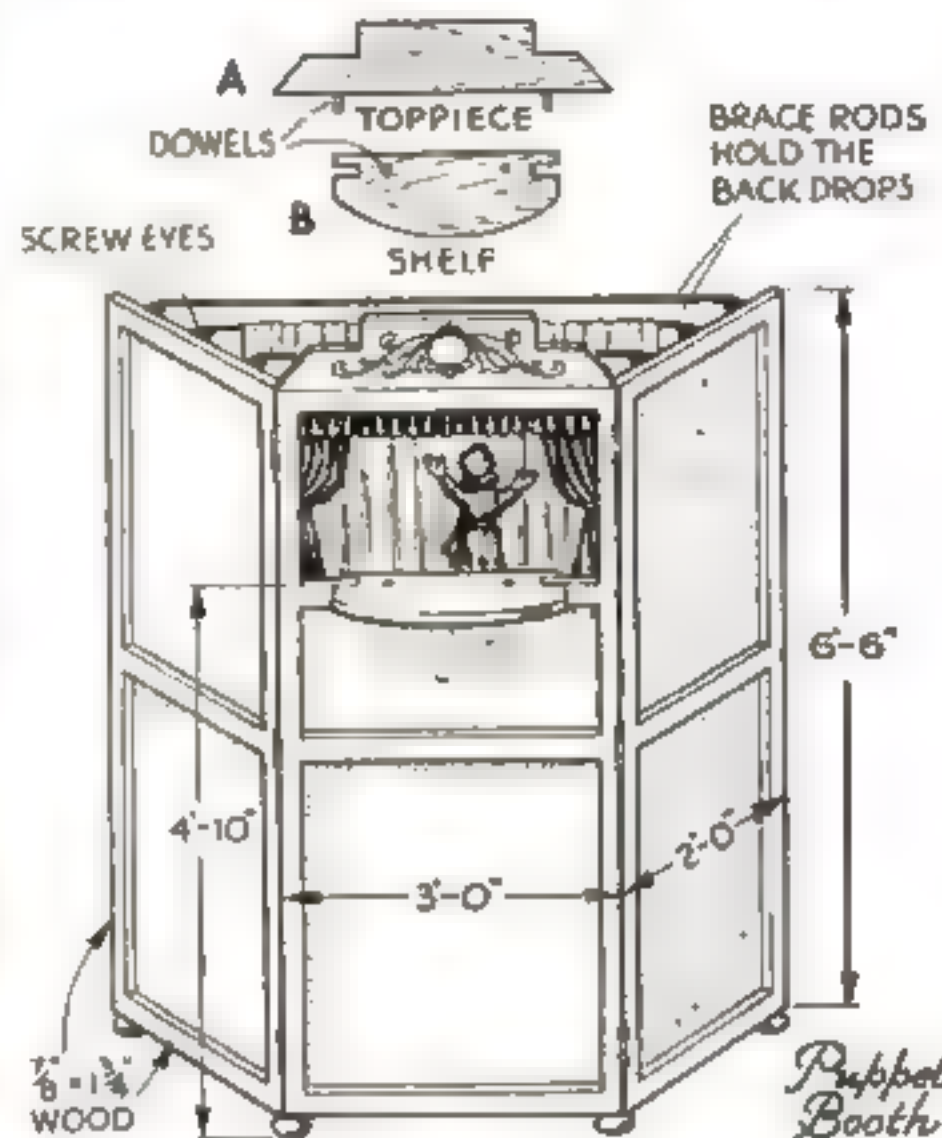
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HOW TO MAKE AND USE HAND PUPPETS

(Continued from page 85)



Puppeteer Seated and Standing



A simple way to construct a suitable booth, and two methods of operating hand puppets

1 to $1\frac{1}{2}$ in. long, made to fit the thumb and finger tip. Finally, the hands must be firmly fastened into the sleeves of the costume. Puppet arms may be elongated by means of additional cardboard tubes placed over the fingers.

For finishing the various parts, tempera paint is preferable to oil paint because it dries without any gloss; poster paints answer well, too. If oil paint is used, mix it with turpentine to dull its gloss. Two or three coats may be necessary.

Coloring can give as much expression as modeling. In emphasizing expression, make sure that it, as well as the color, carries across the room. White, yellow ochre, and a touch of vermilion give a normal complexion, with accents of red added to the corners of eyes, nostrils, and ears. Use blue or violet shadows in eye sockets, and sweeping dark lines for eyebrows and lips. Add last a touch of shellac or glue to eyes and teeth to make them glisten.

For a hand-puppet theater three things only are essential: a screen or a curtain to hide the operator, a background (curtain or back drop) to make the figures and faces stand out, and a strong light arranged above and in front to shine directly on stage and puppets. While a makeshift theater can be arranged in a window or a doorway, it is advisable to have a well-planned stage on which various experiments in scenic and lighting effects may be tried out.

Nothing is better suited to this type theater than a threefold screen. For the uprights, get six lengths of $\frac{7}{8}$ by $1\frac{1}{4}$ in. by 6 ft. 6 in. pine or cypress, dressed on all four sides. For the crosspieces of the two end frames, you need four similar strips 2 ft. long; and for the crosspieces of the center frame, obtain four pieces 3 ft. long. Make a full-size draw-

ing of the ornamental toppiece A and the floor-piece shelf B, both of which should be cut from $\frac{7}{8}$ -in. thick wood. These, as shown in the drawing, are made to come off so that the screen will fold flat. Six double-swing screen hinges hold the panels together.

The side panels and the lower part of the center panel may be filled in with a lightweight fiber wall board or with sateen gathered on brass rods at top and bottom. Use your taste regarding the color scheme. The frame should, of course, be painted in harmony with the covering. Three screw eyes are used at each side of the top strip of the side panels to take metal rods or heavy wire. These wire braces hold the wings rigidly and also support the back drop and drapes for either a deep or a shallow stage, as need be.

In hand-puppet booths, where most of the floor is trapdoor, furniture, when used, must be prevented from falling through. It should be mounted on thin pieces of wood and attached to the apron (shelf B) or to a strip of wood across the back of the stage with iron turn buttons or small wing nuts, which can be screwed to the stage floor in convenient places. It takes only a moment to turn these



Suggestions for making characteristic head-dresses to represent various historic periods

fastenings over the edge of the thin wood.

The costume should be large and long enough so the operator's hand is not crowded for room or his wrist left exposed. The bending of the wrist (the puppet's waistline) is flexible enough to represent a variety of movements.

The clothes and body of a hand puppet are, of course, one and the same thing. The foundation garment is a straight skirt or shirt about 14 in. long and 18 in. wide, doubled. Gather or pleat the material around the neck, and then sew or (Continued on page 119)

\$250 to be Awarded for Trailer Kinks

FIFTEEN cash prizes totaling \$250 are offered by POPULAR SCIENCE MONTHLY for the best construction kinks to be used in building camping trailers. Recent auto shows have indicated tremendous public interest in trailer touring, so this special contest is being held to discover new, practical, and money-saving ideas for the benefit of readers who are planning to construct trailers of their own this spring.

You don't have to tell how to build a complete trailer. Just concentrate on the one best kink you have developed and tell about it in 500 words or less, using sketches, drawings, or photographs to illustrate the idea. Contest rules were given last month (see P.S.M., Jan. '37, p. 91). All entries must reach the Trailer Contest Editor, POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York, on or before February 1, 1937.

The prizes will be awarded as follows: first prize, \$100; second prize, \$50; third prize, \$25; fourth prize, \$15; fifth prize, \$10; sixth to fifteenth prizes, \$5 each. In case of ties, each tying contestant will be awarded the prize tied for. Anyone who has developed a good construction kink while building his trailer is eligible. More than one idea may be submitted, but each must be made a separate entry. No entries will be returned.

MAKING HAND PUPPETS

(Continued from page 118)

tack it about the throat of the puppet. Before doing this, sew in the right sleeve 1 in. down from the neck and the left sleeve 2 in. down, because the middle finger forms the right arm and the thumb, the left. This, of course, must be reversed if the puppet is used on the left hand.

A small cushion or block of wood is often hung by tapes to the puppet's neck in front so that it can be held firmly by the puppeteer's two unused fingers. This contrivance holds the puppet's head and body more firmly and also makes its chest more shapely. Capes, collars, and scarfs improve the effect of the arms, disguising their short length.

Headdresses are very important. They can add distinction and character, as well as indicate the country and period.

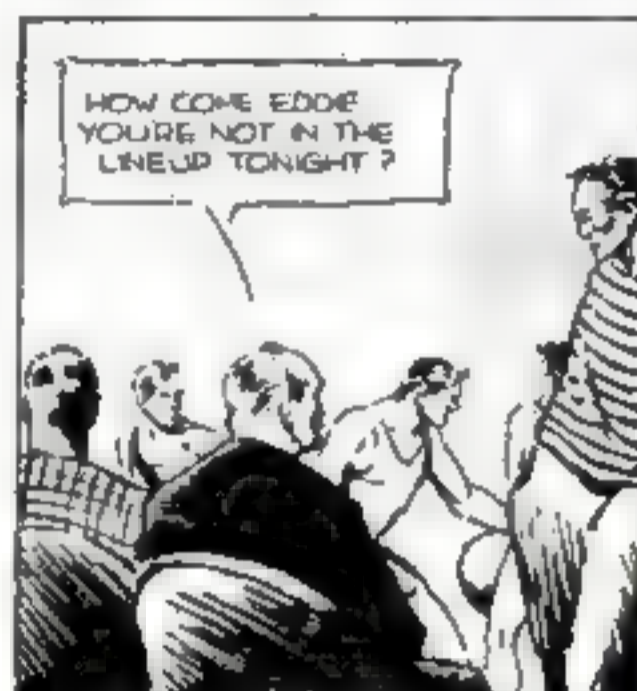
Gestures must flow smoothly one into the other, without haste. Study gestures before a mirror. Time must be given to study, experiment, and rehearsal. Only the puppet who is speaking should move. Let there be no movement lacking in meaning. A serious fault is to hold the puppets too low; let them enter with all the body visible. The action should be down stage, and the puppet must be held vertically.

The length of the play should be from ten to twenty minutes. Have no monologue over fifteen or twenty words. Appropriate music is the salvation of many a performance.

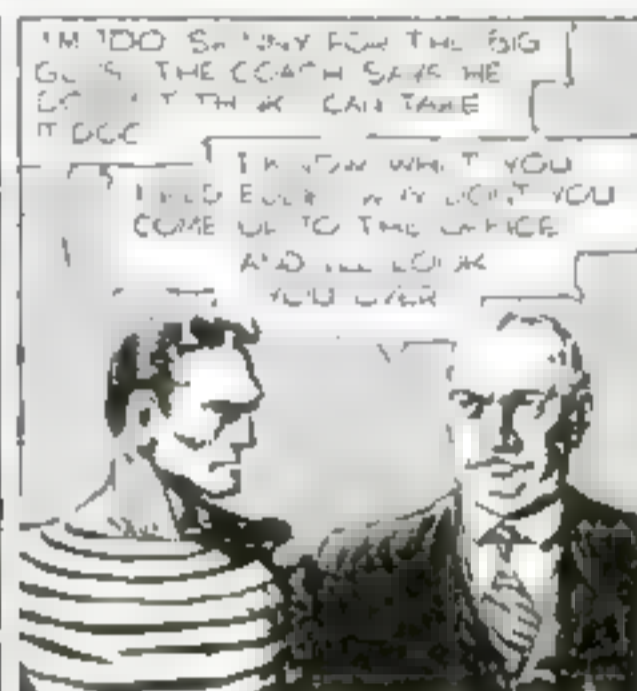
The height of the platform determines whether you operate standing, kneeling, or sitting. Many now are experimenting with the latter position and find it less tiring. A semitransparent back drop is used, and through this it is quite easy to see the puppets although the manipulator himself cannot be seen. There should never be any light back stage.

SKINNY SCRAWNY EDDIE MAKES THE TEAM!

HOW A FRAIL, SICKLY, UNDERWEIGHT, LAD FOUND THE WAY TO HUSKY POUNDS, FLASHING SPEED, ENDLESS ENDURANCE, AND BECAME A BASKETBALL STAR!



HOW COME EDDIE YOU'RE NOT IN THE LINEUP TONIGHT?



IM TOO SKINNY FOR THE BIG G. THE COACH SAYS HE CANT TAKE IT.

IK TELL YOU WHAT YOU NEED EVER WAY LEFT YOU COME UP TO THE OFFICE AND WE WORK YOU OVER



WHAT YOU NEED IS IODINE IN YOUR BLOOD AND GLANDS TO HELP YOU CHANGE FOOD INTO STRENGTH. IVE GOT TO PUT YOU ON KELPAMALT RICH SOURCE OF IODINE THERE IS!



A MONTH LATER

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THE COACH SAYS WE'RE WINNING THE GAME. SMILE HANDED!

WHAT A CHANGE HE WAS A SHINNY JACK A MONTH AGO!



AFTER THE GAME—A HERO!

SEE EDDIE YOU PLAYED SWELL TONIGHT!

AND LOOK HE WAS EVEN TIRED!

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Small Gas Furnace

Gives Great Heat for Melting Metals

By
EVANS W. BUSKETT
Consulting Engineer



The forms in position for pouring the filling material, which is fire clay and sand, mixed



The furnace in use. It melts copper, brass, aluminum, gold, and silver. An old vacuum cleaner supplies air

A MELTING furnace that will attain a white heat in less than thirty minutes can be made from two discarded cans and a few pipe fittings. Measured by means of a pyrometer with a rhodium-platinum thermocouple, the temperature of the furnace illustrated was found to be 1,523.5 deg. centigrade. This is the highest temperature I have ever known a laboratory gas burner to give, and I have been using burners for the past forty years.

In fifteen minutes after being started, the furnace is red hot all over, and in thirty minutes it is so white hot that the crucible in it can hardly be seen. The top of a clay crucible was warped out of shape in fifteen minutes after it was put into the hot furnace. A brickbat is used as a cover, and vents are provided at the top by placing the brick so that there will be openings through which the flame may escape.

Copper, brass, aluminum, gold, and silver can be melted in the furnace. It can be used for assaying lead, and in the preliminary melting for gold and silver assays. It is very durable and should last for years with proper care. Many melts have been made in the original furnace, in one of which the crucible burned through and all of the slag spilled into the furnace. Another crucible boiled over. In spite of this drastic treatment, the furnace is in good condition.

The container of the furnace is made from a can about 7 in. in diameter and the same in height. The inner form is a quart can about 4 in. in diameter and 4½ in. high. Holes for the burner are cut in the large can about 2 in. from the bottom, and in the smaller can, flush with the bottom. A crucible is used as the form for the burner hole. One of the photographs shows the cans and crucible assembled for pouring.

The filler is made of a mixture of equal parts of fire clay and sand; and a tablespoon of salt will improve the binding qualities. A good grade of fire clay should be used. The ingredients are mixed thoroughly while dry, and then made into a thick paste with water. The mixture is put into the forms a little at a time and worked down firmly with a stick. It is not necessary to treat the crucible to prevent its sticking to the clay. It will draw out very easily, and can be broken off and used later as a burner bushing.

To break off the bottom of a crucible, it should perhaps be noted, is quite difficult to do without breaking the crucible in the wrong place. Place the crucible right side up on a heavy, flat piece of iron. Insert a blunt iron rod, hold it squarely on the bottom of the crucible, and strike it a sharp blow with a heavy hammer. There will be few failures by using this method. The lower part of the shell can then be trimmed to the proper size with a pair of pliers.

After being filled, the forms should be allowed to set for several days, and then placed in a warm place for a few days longer. On top of a boiler is a good place for the final drying.

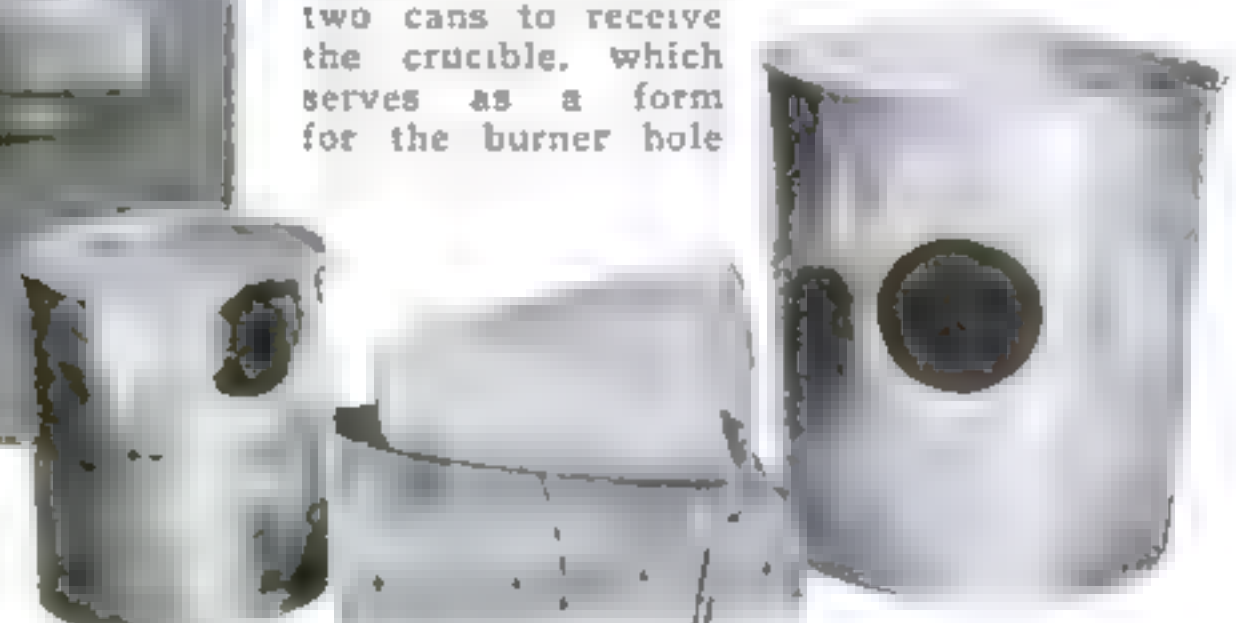
Neither can used as a form is removed. The outside can acts as a container and prevents the furnace from falling to pieces in case it cracks. The inside can burns out in a short time, so it is not necessary to remove it. The clay-and-sand walls eventually break down, but it takes a long time because the melting point of the mixture is so high.

At first the burner hole was not bushed, but after the furnace was in use the hole soon



The burner is made of ordinary pipe fittings and connected with the gas supply and vacuum cleaner

Holes are cut in the two cans to receive the crucible, which serves as a form for the burner hole

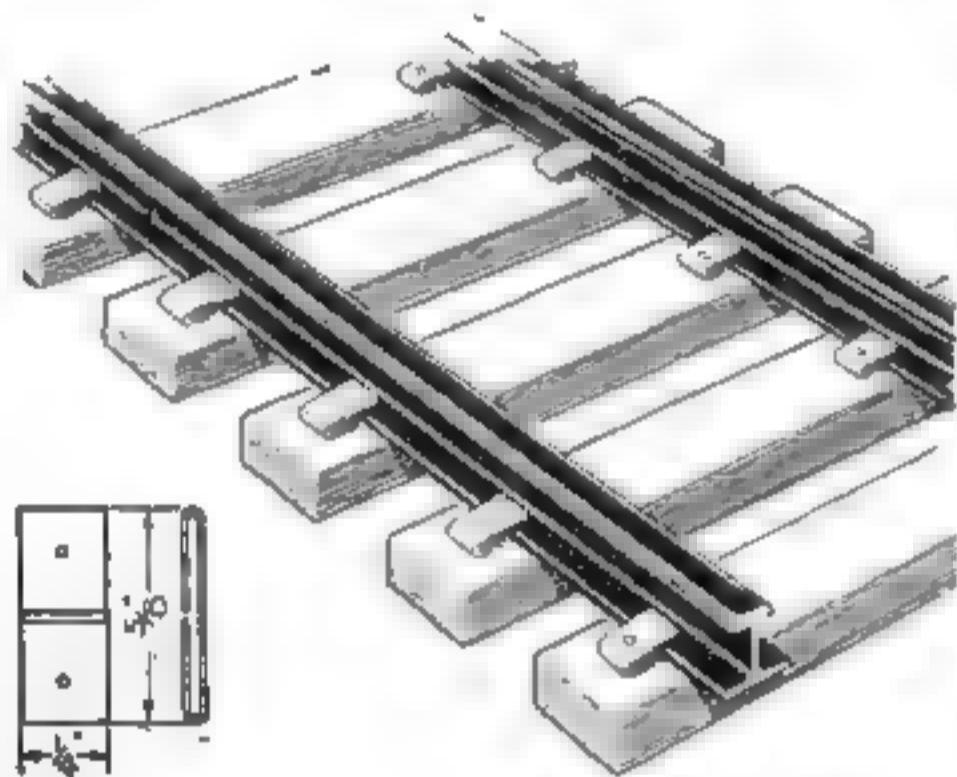


burned out to such a size that a bushing was necessary. The bushing, made from the crucible as previously suggested, is fastened in place by a mixture of fire clay and sand. The large part of the crucible is, of course, on the outside.

The burner is made from an ensemble of pipe fittings. It consists of a 1-in. cap, a 6-in. long nipple, one T, one close nipple, one floor plate, and one Y. The floorplate and close nipple are filled with lead to add weight. Twenty-five $\frac{1}{8}$ -in. holes are bored in the cap as shown. The Y is reduced to $\frac{1}{2}$ -in., and the side opening is connected with the gas supply by a regulating cock, which is drilled out to $\frac{1}{4}$ in. The other opening to the Y is connected directly with a blower made by cutting off the superfluous parts of a vacuum cleaner. It has been found that the sizes mentioned, that is, $\frac{1}{4}$ -in. for gas and $\frac{1}{2}$ -in. for air, make the proper mixture of air and natural gas for high temperature. Where manufactured gas is used, or the pressure is different, other proportions will have to be worked out experimentally, using the above figures as a starting point.

The intake for air may be made larger, and a valve used to regulate the flow. This was tried with a $\frac{1}{2}$ -in. valve, but it cut down the quantity of air so that there was not enough to give maximum efficiency.

MODEL RAILWAY TRACKS LAID WITH TIE PLATES



MADE from scrap tin, the combined tie plate and rail brace shown above lend realism to a model railroad and make the laying of track on individual ties a less tedious operation. As many clips as desired are slipped on to the rail base, centered over the ties, and "spiked" with a small brad. To prevent any creepage of the track, an occasional brace can be fastened to the web of the rail with a drop of solder.

The holes for the "spikes" can be either drilled or punched with a sharp nail. Much time can be saved if enough stock for ten or twelve clips is bent up as a single piece, and the individual lengths are cut off with tin snips. The dimensions shown are for standard gauge rails.—H. W. DRYDEN.

FLATIRON HEATS HEAVY WORK READY FOR SOLDERING

WHEN a heavy object must be soldered with a relatively light soldering copper, preheat the work by bringing it into contact with a heated flat iron and then apply the soldering copper in the regular manner. By doing this, the work and copper may be kept at a sufficiently high temperature to cause the solder to flow freely.

If it is not preheated, the heavy work will absorb heat from the copper, thus lowering its temperature and preventing the desired free flow of solder. Many unsuccessful soldering jobs done in the home workshop can be traced to the use of a copper too light in weight for the work at hand, and to failure to preheat in such cases.—P. A. STARCK.

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Even pretzel bending has gone over to the machine . . . a loss to the arts, but another victory for Gambrinus.



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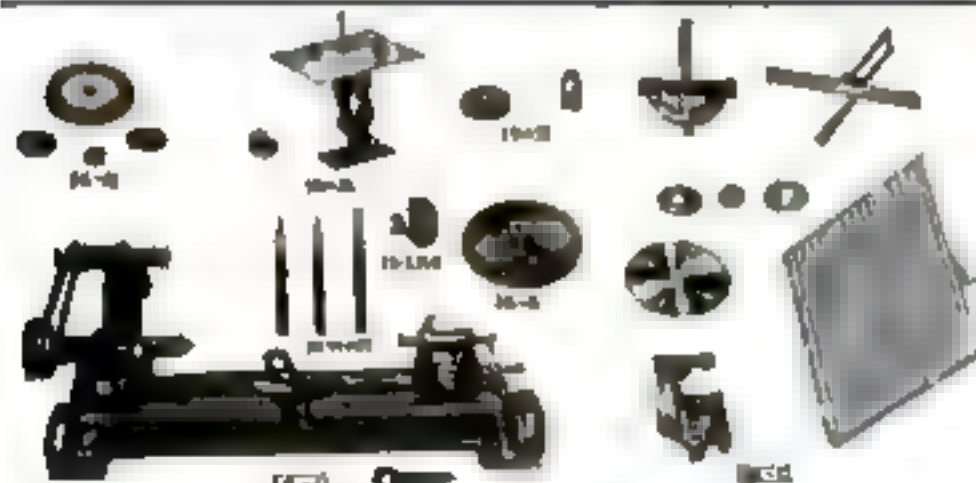
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WHAT YOU CAN DO WITH Old Tooth-Paste Tubes

By
**EDWARD
BURNHAM**



Small wood turnings may be given a metallic appearance by coating them with shellac and then spinning foil over them



For convenient use, glue, water glass, and various pastes may be poured into old tubes

EMPTY metal tubes of the collapsible type in which tooth paste, shaving cream, and other substances are packed may be put to a variety of uses. By removing the binding strip at the bottom and washing out the inside, they can be refilled with materials ordinarily sold in cans, such as glue, water glass, soldering paste, or other pastes that are easier to apply from a tube.

To make use of the foil itself, slit the tube, open it flat, and remove the enamel printing from the outside by rubbing with steel wool and acetone. This will leave a brilliant polish, and any wrinkles can be smoothed out by rolling with a pencil. Cut with scissors into letters and numerals, the foil can be cemented to glass for neat signs or house numbers like the one illustrated below. Suitable cements are fish glue, shellac, or copal varnish. A method that requires some skill but gives a mirror brilliance is to daub the backs of the letters with mercury, which amalgamates the entire thickness. Allow it to set for a day; then coat the back of the signs with black varnish.

The reflecting power of shades on desk lamps and other light reflectors may be increased by cementing sheets of the foil over

the inside and burnishing the laps so that they are invisible. Rub with fine steel wool for a brilliant polish, and protect the finish with a coat of thin lacquer.

A unique decorative treatment for wood surfaces consists in cutting the foil into suitable designs, which are applied with shellac and pressed into the wood surface with a heated electric iron. The designs will then have the appearance of metal inlay. Sheet brass or copper can be decorated in the same way by pressing the designs in place with a little soldering paste, then heating until the foil almost reaches the melting point.

The foil can also be spun over small wood turnings to give them the appearance of being made of metal. Coat the turning with shellac and hold a sheet of the foil against it with a wood disk, which is in turn held in place by the lathe tailstock as illustrated above. Run the lathe at slow speed and mold the foil over the turning by means of a burnisher or the end of a test tube. Hold a piece of fine steel wool against the foil for a high polish.

Stick solder that can be applied with the heat from a match is made by coating a sheet of foil with soldering paste and then rolling it up into a slender tube.

Pouring from a metal can having a screw top is made easier by soldering to the latter the top and screw cap from a tooth-paste tube. A hole must, of course, be drilled in the regular top beforehand.

With a little ingenuity, you can devise other ways of using these metal tubes



A house number made by cutting figures from an old tube and cementing them on glass, which is then coated with black varnish. Left: Using foil for soldering

NEW SCREW FEED LATHE

METAL TURNING LATHE WITH LONGITUDINAL SCREW FEED
No. 255-6x18" ONLY



Length overall 30". Machined semi-V ways. Threaded hollow spindle No. 8 Morse Taper Centers. BRONZE TAPERED TAKE UP BEARING. 1/2" tailstock set-over. Compound carriage travels on semi-V ways gibbed for take-up. Included: Two 60° centers, tool post assembly and 4" face plate—3" four jaw chuck \$3.50; 4" chuck \$4.50; Chuck bushing 50 cents. Send \$2.00 with order, balance C.O.D. Shipping weight 30 lbs. FREE—32 page catalog.

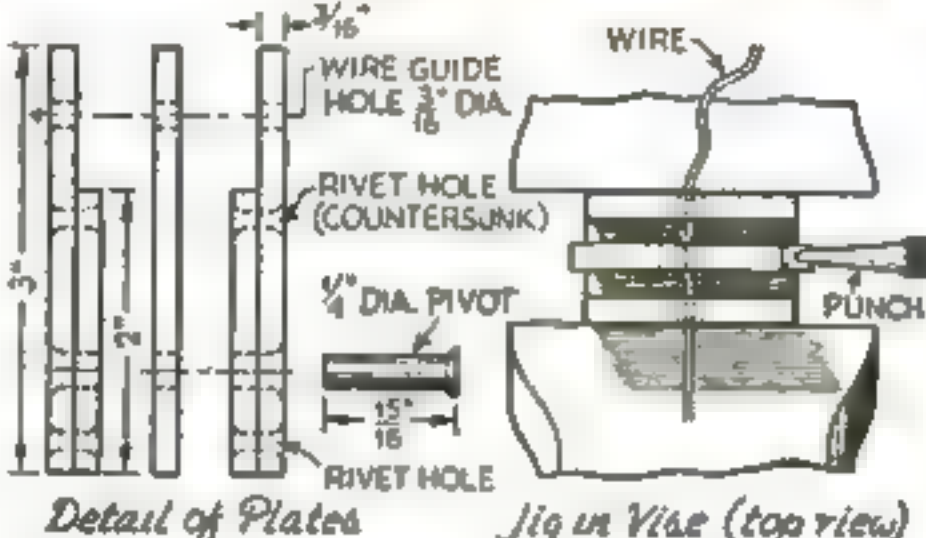


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NOVEL JIG STRAIGHTENS MANY SIZES OF WIRE

MADE from five pieces of light bar steel, this wire straightener will handle any size of wire up to No. 8 gauge and any material except hard steel.

From a bar of steel or wrought iron 1 by 1/2 by 3/16 in., cut three pieces each 3 in. long and two pieces 2 in. long. Make both the front and the back plate of the jig by riveting together a 3-in. piece and a 2-in. piece, as shown. The third long piece is the adjustable center plate. Clamp the three plates together and drill a 1/4-in. hole clear through them,



Detail of Plates Jig in Vise (top view)

After the wire has been started through the three holes, the center plate is pushed to one side sufficiently to straighten the wire

countersinking the hole at both ends for a long rivet, which acts as a pivot for the center plate of the jig. Also drill a 3/16-in. hole through all the plates near the top to serve as wire guide holes.

To use the device, clamp it without too great pressure in the vise with the guide holes in line. Pass the end of the wire to be straightened through them and then, with a punch, drive the center plate to one side, the distance depending on the size and kind of the wire. The farther over it is moved, the harder it will be to pull the wire through and the greater is the tendency to stretch and straighten the wire. After driving this plate aside, tighten the vise jaws and proceed to draw the wire through. Pliers may be used to pull small iron or copper wire, but regular wire clamps may be needed for the larger sizes.—W. C. W.

HOOK HOLDS PAINT CAN AND BRUSH ON LADDER

A hook made of 1/4-in. rod bent as shown is handy for holding both paint pot and brush. The hook fits into a 3/8-in. hole drilled through the brush. This idea saves considerable time when working on a ladder and using two colors, as the brushes cannot fall to the ground and any drippings fall back into the pot.



Double-purpose hook

—OREST NELSON.

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Scientists recently discovered that thousands of people are thin and rundown for the single reason that they do not get enough Vitamin B and Iron in their daily food. Without these vital elements you may lack appetite, and you don't get the most body-building good out of the food you eat.

Now one of the richest known sources of Vitamin B is cultured ale yeast. By a new process the finest imported cultured ale yeast is now concentrated 7 times, made 7 times more powerful. Then it is combined with 3 kinds of iron, pasteurized whole yeast and other valuable ingredients in pleasant tablets.

If you, too, need these vital elements to aid in building you up, get these new Ironized Yeast tablets from your druggist today. Note how quickly they increase your appetite and help you get more benefit from the body-building foods that are so essential. Then day after day watch flat chest develop and skinny limbs round out to natural attractiveness. See better color and natural good looks come to your cheeks. Soon you feel like an entirely new, much stronger person, with new charm, new personality.

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Easy Way to Inlay Metal with Metal

By
**KENNETH
MURRAY**



A scrap piece of metal is set on top of the work to be inlaid and connected with the dry battery

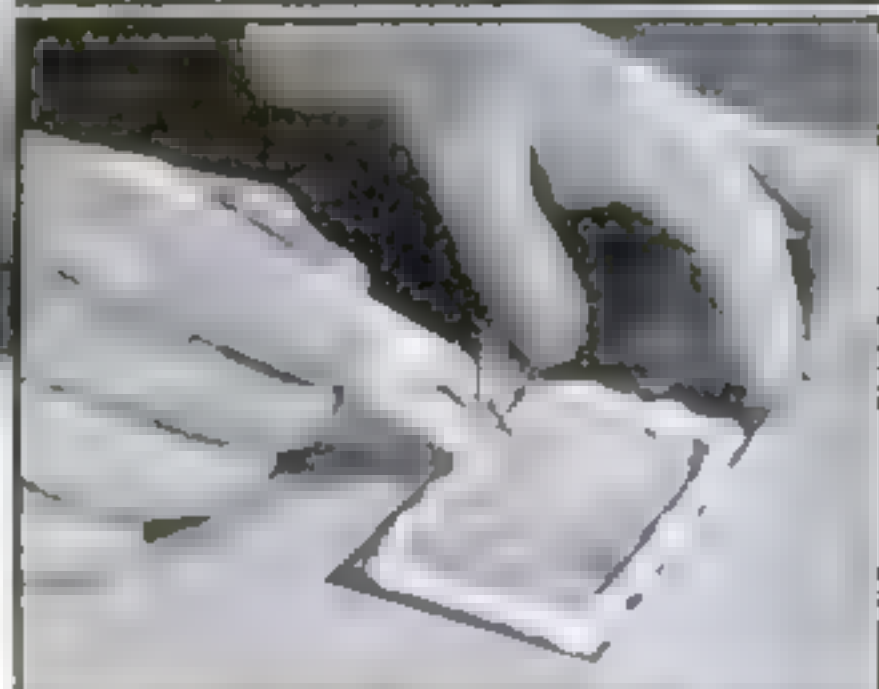
BY A SIMPLE electrochemical method, you can inlay metal with metal. It is practically automatic and not much skill is required. The lack of a perfect fit sometimes seen in wood inlay work is impossible. You can make metal name plates, and inlay designs, drawings, and lettering in metal fixtures of all kinds, to say nothing of giving an everlasting identification to shop tools.

All flat metal surfaces may be inlaid without the use of a tank for holding the chemical solutions used. First heat the metal and then flow it with a thick coat of paraffin or wax from a candle. Cool it quickly by laying it on a slab of cold metal or on the table of the circular saw.

With a sharp metal point, remove the wax where the inlay is to appear. When making broad lines and spaces, use the point or edge of a knife. Thus far the method is the same as for ordinary name etching.

A low wall must be built up with candle drippings around the design. Level the metal and pour into the walled-in space a small quantity of very dilute sulphuric acid until the surface of the liquid extends slightly above the top of the wall. Rest a flat piece of scrap metal (copper or steel) on top, and you are ready to remove the metal exposed in the design, which action takes the place of routing when working with wood. Connect the positive pole of a dry battery (one or two cells) with the metal to be inlaid, and the negative pole with the scrap piece placed on top, as shown in one of the photographs. The action will start at once. The design will be sharply eaten to any depth you desire to inlay. Inspect the work frequently and remove bubbles of gas that accumulate.

Without injuring the wax design, the metal can now be rinsed thoroughly and any sediment lightly brushed away with a tuft of wet cotton. It can now be covered with a "filling" or plating solution, and a piece of the same metal as that to be inlaid is placed on top. Reverse the electrical connections and inspect the work occasionally as the plating progresses until the lines

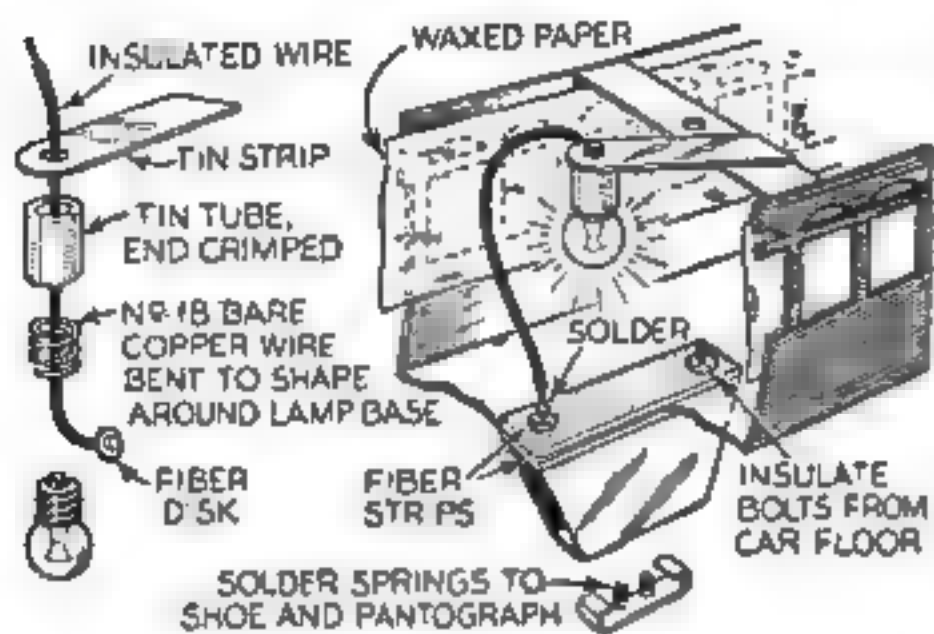


The name plate or other work is flowed with wax, and the lettering or design scratched through. Next a wall of candle drippings is built up around the edge, and into the reservoir thus formed a small quantity of very dilute sulphuric acid is then poured

have been entirely filled with the new metal. The wax can then be removed and the design ground down evenly and buffed to give a highly polished inlay.

The metal chosen for inlaying (as in the final operation) should, of course, contrast with the metal in which it is to be laid. Plating solutions for different metals have been given in various articles on this subject and are available in many handbooks. However, as copper is a metal that will often be selected, one convenient solution is suggested: Distilled water, 8 oz.; copper sulphate, 1 oz.; sulphuric acid, 10 drops. Solutions containing cyanide are also suitable, but they are, of course, poisonous.

MAKING LAMP SOCKETS FOR MODELS AND TOYS



Parts used in assembling a small lamp socket, and a lamp mounted in a model railway coach

S MALL lamp sockets for toys and models are easily made from tin scraps and bare copper wire, such as bell wire stripped of insulation.

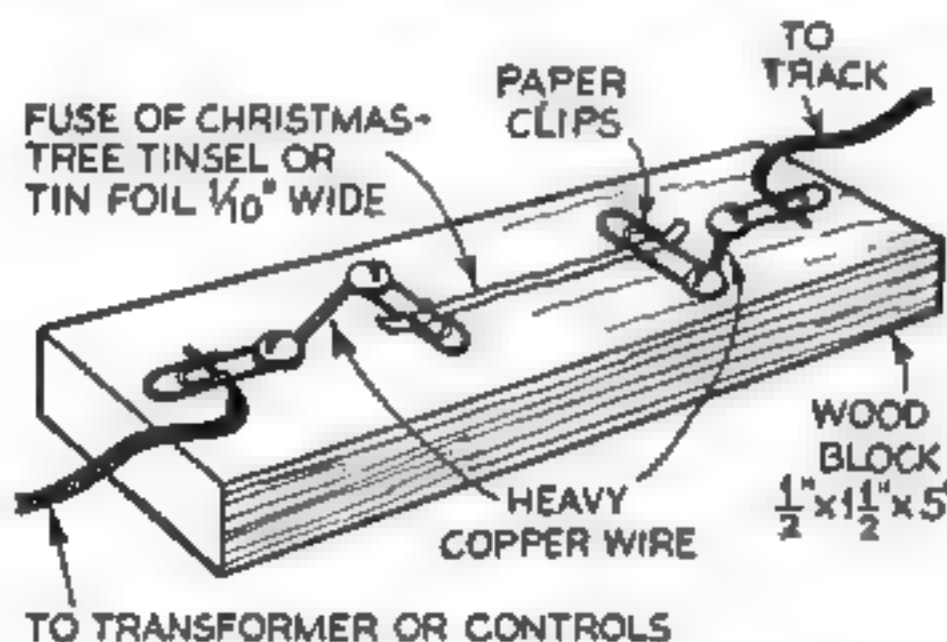
A small tube is first formed by bending a strip of tin around a pencil of suitable size. The ends are cut in tabs and crimped over as shown. Tin the inside of the tube with solder. Now wind a piece of the copper wire around the base of a bulb, making it fit the threads. Unscrew the coil from the bulb, tin thoroughly, and solder into the tube. The small fiber disk carries a center contact made of a lump of solder on a loop of wire. The disk should be just small enough to pass through the coil of wire.

If the socket is to be used to illuminate a model railway coach, a third rail contact will be needed. The type shown is simple and efficient. Waxed paper inside the coach windows serves to diffuse the light and, at the same time, prevents the wiring and apparatus from being seen.—JOHN L. STORY.

TIN-FOIL FUSES GUARD MODEL RAILWAY LINES

E VERY model railroader has complained, at some time or other, of the cost of replacing fuses that were blown when a train jumped the track, or of the initial cost of an automatic circuit breaker. Here's a way you can solve the difficulty in a few minutes time without going to any expense.

Obtain a wooden block $\frac{1}{2}$ by $1\frac{1}{2}$ by 5 in. or larger and fasten four paper clips with



When a wreck or short circuit occurs, this homemade fuse blows out and prevents damage

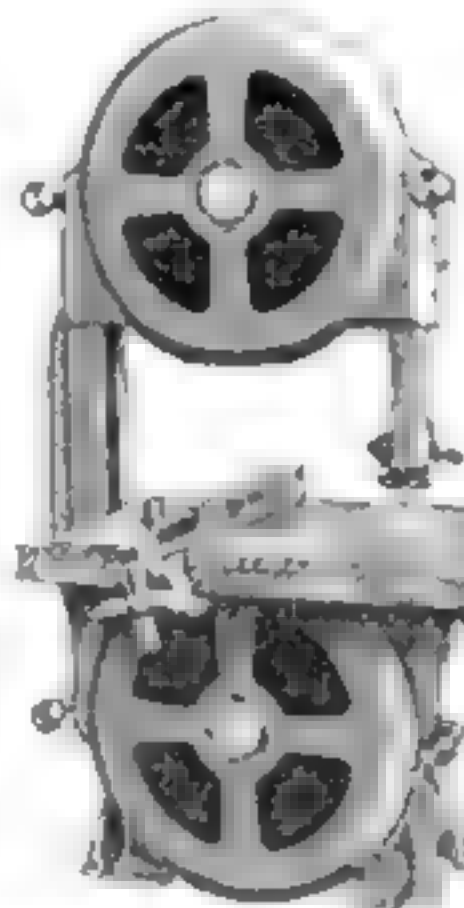
screws and copper wire as in the sketch. Bend the smaller loop of each of the end paper clips down to hold the connecting wires. The fuse, which is held between the middle clips, is either Christmas-tree tinsel or a strip of tin foil cut $\frac{1}{10}$ in. wide. Do not use more than one strand of tinsel or a wider strip of tin foil; it would carry too much current and defeat the purpose of the fuse. For best results, use one of these fuse holders at every place the current is connected with the railroad track.—W. W. SLEATER III.

Send in your best model railway construction hints. Payment is made for all found suitable for publication.

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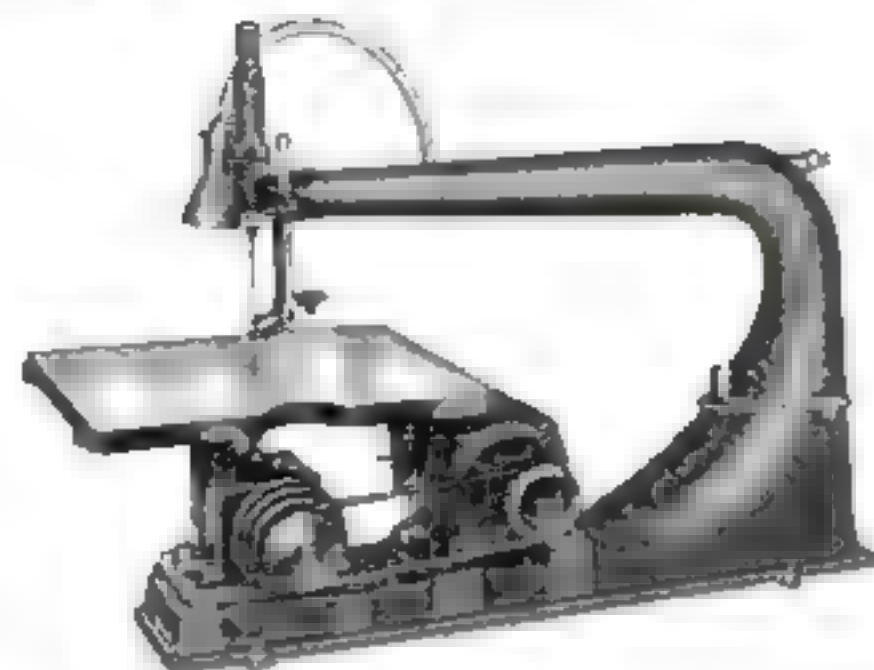
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With the LITTLE GIANT MAGNET you can see for yourself just how powerful it is. One, 30c; Five, 25c each; Ten or more, 23c each. Use the order form below.

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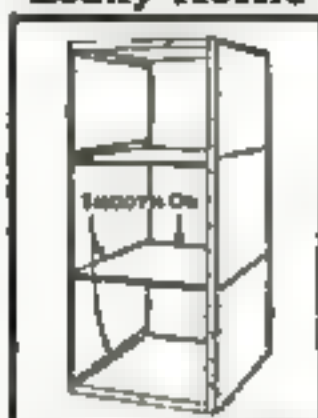
Smooth-On
Radiator



Leaky Pail



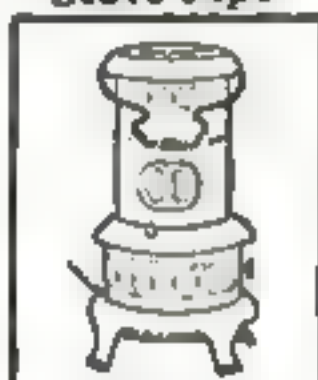
Leaky Kettle



Leaky Tank



Stove Pipe



Oil Leaks

PROBLEMS OF SCIENCE AND INDUSTRY SOLVED BY TOM THUMB CHEMISTRY

(Continued from page 49)

to be subjected to electrical tests elsewhere in the building.

That sounds like a tough assignment for any chemist. But watch the microchemists go about it. One of them picks up a little tapered plate of glass, roughened on one side by sand-blasting. He draws it lightly across the contact point. The faint metallic streak left on the glass is all he needs. He rests the plate in the neck of a slender glass vessel. Fumes of aqua regia, the "royal water" that dissolves even gold or platinum, act on the metallic deposit and convert the metals into various salts—some soluble in water, some insoluble.

FROM a hair-fine tube of glass in his right hand, the microchemist now applies a drop of water to the plate. Then, drawing the drop back into the same tube, he transfers it to a microscope slide. He selects a vial labeled "Thallium Nitrate" and deftly adds a tiny fragment of the chemical, using a glass filament as a tool. Through the microscope eyepiece he sees needlelike crystals appear. He writes down, "Gold."

Returning to the original glass plate, the microchemist treats the remaining stain with ammonia and lets the droplet evaporate under the microscope lens. Crystals again appear, this time in the form of squares and triangles. To his report he adds, "Silver."

From the characteristic shapes of the crystals he sees—in these cases, of compounds known as thallous gold chloride and as silver chloride—and from rapid, confirmatory "spot" tests with treated papers that change color in the presence of certain metals, the microchemist can tell in a jiffy just what went into the contact point. If it shows up favorably in electrical tests, his company knows what to use in the future; if it has caused a service failure, the company knows what to avoid, and another alloy will be substituted. Here is a case where the permissible sample was so small that nothing but microchemical methods could have been used.

A piece of lead from the sheathing of an underground telephone cable is brought in to find out what made it corrode—and microchemistry scores from another angle. There is plenty of lead to analyze, but ordinary chemical methods may fail for a curious reason. Scattered, microscopic pockets of highly concentrated alkali in the metal are telltale signs that stray electric currents in the ground were to blame for the cable's deterioration. If the sample is analyzed as a whole, its contents are "averaged," the alkali is diluted, and nothing abnormal is found. Local tests on a microscopic scale, however, reveal the strongly alkaline pockets and the true cause of corrosion. In fact, the lead can be "dissected" under the microscope like a biological specimen, and the progress of corrosion followed from the outside in, layer by layer. Tests like these are saving huge sums by reducing cable losses.

COAL occupies the center of the stage at another of America's leading microchemical laboratories. Directed by Dr. W. R. Kirner, this miniature-chemistry center plays an invaluable role in the work of the Carnegie Institute of Technology's Coal Research Laboratory at Pittsburgh, Pa.

A group of firms whose names look like a "Who's Who" of American industry have supported the Coal Research Laboratory. They include the U. S. Steel Corporation, the General Electric Company, the Koppers Company, the New York Edison Company, the Standard Oil Company of New Jersey, and the Westinghouse Electric and Manufacturing Company. All these great organizations are

interested in the question, "What happens when coal is heated?"

Strangely enough, analyzing tiny samples of coal with midget equipment reveals traces of substances that would be missed in a man-size laboratory. The cost of miniature apparatus and microchemical reagents is relatively low. It takes far less time, too, to determine the exact quantities of moisture, carbon, hydrogen, sulphur, methoxyl, oxygen, and ash in an almost microscopic sample of coal than in a specimen hundreds of times as large. So Dr. Kirner uses trinkets as laboratory ware. A tiny nickel "bomb" for testing the amount of sulphur and various other substances in coal resembles something turned out by an expert jeweler. Tiny "boats" or trays of porcelain and of platinum hold the minute quantities of coal while they are being analyzed. A glass-and-rubber filtering device uses a disk of filter paper a quarter of an inch in diameter, no larger than the end of a lead pencil. Fingers would prove too clumsy to handle many of the implements, and they are usually moved about with platinum-tipped tweezers.

ALTHOUGH the work of the Coal Research Laboratory has been, by nature, a matter of scientific study with no definite commercial goal in view, its findings have repeatedly made valuable contributions to industry. Improved methods of manufacturing coke have been suggested by its work. A careful study of the chemical changes that occur when coal burns normally, as in a furnace, have pointed the way to improvements in mechanical stokers for home and industrial use. The research has shown how a number of new substances may be made from coal on a commercial scale—chemicals which were formerly unknown to industry, or obtainable only in small quantities. Some of these products may prove to be of tremendous value.

With laboratories like these setting the pace, more and more industrial concerns are adopting "Tom Thumb" chemistry to solve their manufacturing problems. One company had exactly three tenths of a gram of a substance valued at \$5,000 a gram, and wanted to know just how much carbon and hydrogen it contained. By ordinary chemical analysis it would have been necessary to destroy the whole lot, worth \$1,500, to find the answer. A microchemist made an accurate analysis using only two one-thousandths of a gram, or ten dollars' worth.

As a time-saver, too, microchemistry appeals to industry. By ordinary methods, it usually takes nearly a full day to make a complete carbon, hydrogen, and oxygen "determination" of a substance—that is, to measure how much of each of these elements it contains. A microchemist can do the same job in less than two hours.

Midget chemistry shows its worth again when highly explosive materials come to the laboratory for tests. Two microchemists were able to make a complete study of highly pure ozone, using only two milligrams. Had it exploded, their lives would not have been endangered.

And so it seems that the miniature-laboratory idea is likely to become as widespread as the miniature-camera movement, for reasons that are similar—convenience, low cost, saving of time, saving of space, and the ability to do things that would be impossible with more bulky equipment and methods. And, just as the use of a miniature camera is likely to force a photographer to be more careful, and thereby make of him a better photographer, so the adoption of "micro-methods" in research generally boosts the efficiency of the chemist in solving the problems of industry.

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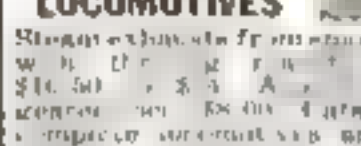
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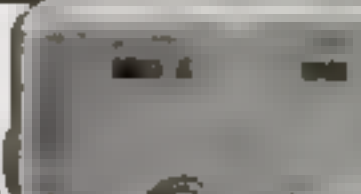
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ARMY OF PARASITES FIGHTS INSECT PESTS

(Continued from page 61)

the dosage increased, but found the insects withstood even the heaviest application. He took infested lemons and oranges to Riverside, fumigated them again, and found that he could not kill the little animals unless he applied so much poison gas that it would destroy the trees as well as the insects.

By gassing the scale insects, he soon found, science actually was building up a harder race, since only the weak perished and the strong survived. Gas after gas was tried, until today only the deadly hydrocyanic gas is employed. Others, of the types used in war, proved useless, since they hung close to the ground. Only hydrocyanic was found neutral to the tree but deadly to the scale.

FUMIGATION is now highly developed. Whereas the hydrocyanic gas once was generated in earthen vessels under a tent-covered tree, it now is delivered as a liquid in drums and delivered through a vaporizer under the tree. Being volatile like ether, the liquid becomes a gas on contact with the air and rises among the branches to kill tens of thousands of scale insects.

The "insect scientists" overlook no opportunity to improve their gas attacks. At the Citrus Experiment Station is a metal form resembling the outline of a tree. On it they try every new kind of leakproof canvas recommended for fumigation purposes; in it they periodically place infested branches and study the effects of gases. Recently a cellulose-type covering, painted black, has been produced in an effort to achieve a tree housing which will prevent the gas escaping within forty minutes, the time necessary to make sure the insects have succumbed to its effects.

Three species of lemon and orange scale insects have resisted all efforts to exterminate them by fumigation. To meet that challenge Professor Quayle and his coworkers have resorted to spraying, using petroleum oil, nicotine, and lime sulphur. Highly refined oils now are sprayed on both citrus and deciduous trees with deadly effects on the insects.

But some insects attack the fruit itself, burrowing into the skin and causing decay. Fumes and ordinary sprays have no effect on these borers, and now a serious effort is being made to reach them through their stomachs. Arsenate of lead was tried, but that affected the quality of the fruit; a fluorine compound was applied, but Government agricultural authorities objected that this might affect human health. So now Professor Quayle is experimenting with a third group of poisons brought together in a single solution which, he hopes, will kill the bugs, yet will neither injure the fruit or affect the health of man.

SOMETIMES the use of parasitic armies has unlooked-for results. Millions of parasites may be released in orchards, only to disappear, victims of an unfavorable climate. Again, they may multiply in staggering numbers. Recently, all the parasites planted in one western orchard disappeared. Investigation showed that they were all females. Not being fertilized, they naturally failed to produce a second generation. Now, precautions are taken to see that both males and females are included. Male eggs, it has been found, do not develop until female eggs are laid in the same insect. Even here, the male eggs will remain dormant until the females are full grown, for the female can breathe liquids, while her mate needs air. When, finally, the female releases the male, he eats her for her pains. Even the sexes are being changed in this strange battle of science. When provided with only half the amount of food they require, female larvae become males.



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HOW ALUMINUM GIVES US DYES AND PAINTS

(Continued from page 71)

would then be too sensitive to shock and might take fire or explode with slight friction.

Aluminum and mercury combine with each other to form an amalgam or alloy of curious behavior. Sandpaper a sheet of aluminum until it is clean and shiny, drop it into a bottle or flask, and shake it with several drops of mercury. You will not need much of the quicksilver; in fact, the small amount reclaimed from the bulb of a broken thermometer will be plenty. The agitation makes the mercury adhere to the cleaned surface of aluminum, or "amalgamate" with it. Now, if you remove the aluminum strip and expose it to the air, small white tufts of featherlike hairs will begin to grow upon it. You can actually see them getting longer as you watch. They consist of alumina, or aluminum oxide.

Immerse the amalgam-coated strip in water and it will decompose the liquid, liberating hydrogen gas. You can prove it is the amalgam that does this, for if you place a small drop of mercury and a plain strip of aluminum in water nothing will happen until they touch each other.

ELECTRIC current offers another way of making the aluminum-mercury amalgam. Roll up two pieces of aluminum foil, taken from candy bars or photographic film, and connect them with battery clips to a storage battery or a group of dry cells. House current may be used instead, if a heating element of 600 or 660 watts is interposed in the circuit. Holding the pieces of foil by the insulated part of the wires attached to them, touch the aluminum strips simultaneously to opposite sides of a drop of mercury, and then pull them away. A brilliant arc is produced. It is a good precaution to wear a pair of tinted goggles to protect the eyes, and the fumes rising from the arc should not be breathed, as the mercury vapor is poisonous. One or two arcings are sufficient to produce the amalgam. Lay down the pieces of foil, watch them for a minute or two, and you will see the mosslike growth of white alumina appear.

The same result can be produced still more effectively by immersing a discarded aluminum tea ball or salt shaker for half a minute or so in a hot solution of mercuric chloride (bichloride of mercury), taking the special precautions that are due this poisonous chemical. Wash your hands carefully after using it, and make sure that nothing you have placed in the solution finds its way back to the kitchen by any mischance.

Remove the dipped object, rinse it with water, and hold it exposed to the air. It becomes warm as the white feathery fronds appear on it, and at times cannot be held in the hands. You can repeatedly wipe off the strange growth, wash the article in water, and dry it with a cloth—and still, after half a minute or so, the alumina tendrils will sprout again! As much as a teaspoonful of the peculiar white substance can be collected from the object.

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LOOK WHERE YOU DRIVE

(Continued from page 78)

don't fit a special mirror," Gus advised, "you can keep out of trouble by glancing in your mirror when you're ready to start away from the curb. If there's no car in sight, wait a few seconds, in case a car may have swung into the blind spot as you glanced at the mirror. If there is a car coming, wait for it to pass in the same way, meanwhile keeping your eye on the mirror to make sure no other car will get close enough to slam you when you do swing out."

"That's a good stunt—I'll remember it," Braxton said, as he climbed behind the wheel again and began to watch in his mirror for cars coming up the road and mentally timing how long it took for them to get by after they passed out of his view in the rear-vision mirror. "Too bad we can't see backward as well as forward in an automobile," he grumbled.

"SOMETIMES you can see better backward," Gus observed. "In a sleet storm, for example. If you keep going, the rear window stays clear, and so does your mirror."

"I meant to ask you about that, Gus. What's the best cure for sleet? I had to get out every few miles and scrape the sleet off the windshield by hand during that storm we had two weeks ago. It was a blamed nuisance."

"Best cure I know of is to keep the windshield glass so hot that sleet won't form on it," Gus suggested.

"Oh! You mean that idea of burning a candle right close to the windshield with a reflector behind it so the light won't shine in your eyes?"

"I wasn't thinking of that way, although it's a good stunt in an emergency," Gus replied. "There are two good ways to keep the windshield above the freezing point. One is to use a special electric heater made for that purpose. It has a grid of heating wires enclosed in a transparent shield, and draws current from the car's battery. Then, there's the latest idea, which is a car heater fitted in such a way that a part of the hot air is thrown against the windshield."

"I don't like anything in my line of vision on the windshield," Braxton objected, "and besides, I leave my car standing around so much nights with the lights on that I have to have the battery charged every so often all winter. I don't want any gadget that'll run my battery down any quicker."

"How about a special heater?" Gus suggested.

Braxton laughed. "I've got a heater now, and I'll be darned if I'm going to throw it away and get a new one just to keep the windshield hot in snow and sleet storms. After all, you don't get caught in a sleet storm or a heavy snow so very often. Aren't there any good emergency stunts that will do the trick?"

"WELL," replied Gus, "the candle stunt is one of them, but it has its disadvantages at night. Even with a shield behind it, there's some light glare. If your headlights are giving poor light because of the sleet or snow that's stuck to them, even a small glare may make it hard to see the road."

"But there are plenty of other ideas you can try," Gus went on. "A simple one is to carry some small bags of salt in your tool kit. They can be about two or three inches in diameter. Then, when you get caught in sleet, or if snow starts freezing to the windshield, tie a bag of salt to the windshield-wiper shaft so it bumps against the glass at the top out of the way of the swipe of the blade itself."

"Wet the bag a little before you tie it in place. As the salt slowly melts, the wiper will keep sweeping the salt water back and forth across the glass (Continued on page 130)

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LOOK WHERE YOU DRIVE

(Continued from page 129)

and the solution will keep the sleet or snow from freezing. When the salt is all gone and she starts to freeze up again, hang up the next bag."

"But salt water freezes, too, if it's cold enough," Braxton objected.

"That's true," Gus admitted, "But if you've got a heater in the car, the air inside will keep the glass from reaching the salt-water freezing point. And when it gets as cold as all that, there won't be any sleet—it'll come in the form of snow, and the snow won't stick to the glass because it wouldn't melt when it struck it. In fact, if the windshield-glass temperature is actually much below freezing on its outside surface, you won't even need a windshield wiper, because the wind that rushes by when you're driving will blow the snow clear of the glass."

"So it does when it's real cold," Braxton agreed.

"And if you don't want to be bothered with bags of salt, you can get the same effect with any one of a number of special wipers on the market. They're filled with a chemical powder that melts to form an anti-sleet solution."

"Sounds like a useful gadget," Braxton exclaimed. "What do you do? Just keep one of the special blades in your tool kit and snap it on when you get caught in a snow storm or it starts to sleet?"

"That's the idea," answered Gus.

"But supposing your windshield wiper is kind of old and hasn't much kick to it, so it won't swing any trick wiper blades, then what?"

"You're a chump if you start out with a wiper in that condition, but if you do get caught, then the only thing to do is pull your coat collar up around your ears, stick your head out of the window, and make for the nearest service station!" Gus grumbled, as he headed for the gas pump to take care of another customer.

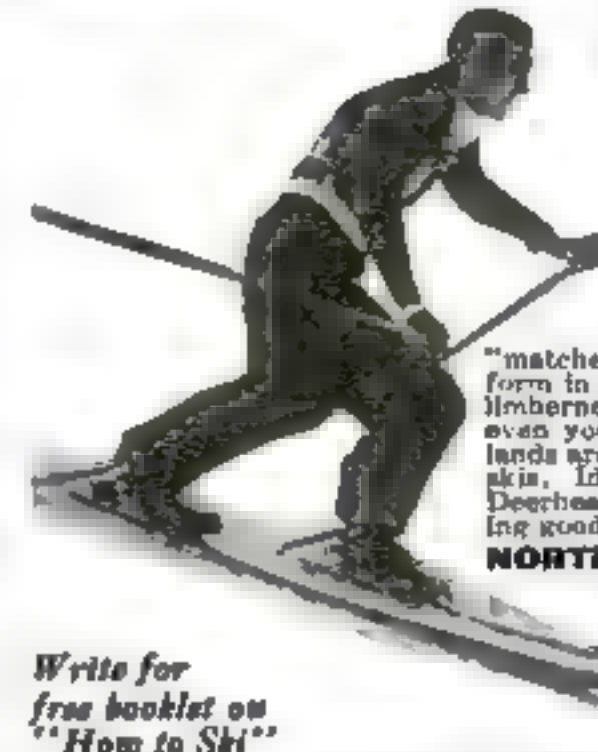
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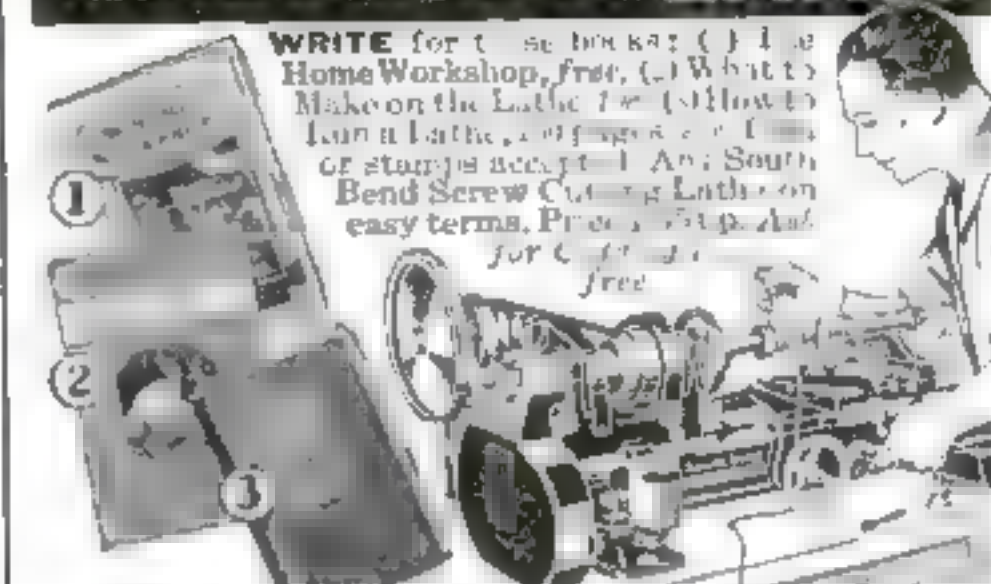


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AMERICA GROWS BAMBOO

(Continued from page 53)

cial groves in the Caucasus. New methods of steaming poles under pressure have been devised by experts here, and the demand for the treated poles has exceeded the supply.

In the event of a paper famine, bamboo is expected to play an important part in filling the gap. French paper mills already are using the long-fibered wood in the production of papers. The reason ascribed for the failure of past efforts to make cheap bamboo papers in quantities is that shipments from the Orient contain a jumble of many species of the wood, no two responding exactly the same to chemical treatment. By obtaining the bamboo from local groves, all of the same species, this difficulty can be overcome.

MOST people think bamboo is exclusively a plant of the tropics. As a matter of fact, one Japanese species flourishes where winter snows are so heavy they break down young stems. Hardy varieties, such as are being introduced into America, are uninjured by temperatures as low as five degrees above zero F. Some have gone through winters with only slight damage when the thermometer recorded zero and below. Regions where the temperature in winter does not drop below five degrees F. are best suited to the growing of bamboo. This is especially significant in view of the fact that millions of acres of cut-over wasteland in the South rarely, if ever, encounter a lower temperature.

Any part of the country where cotton is grown successfully is suitable for bamboo culture. The South Atlantic States, the Gulf Coast States, parts of Tennessee and Arkansas, and valleys on the Pacific Coast, especially in Southern California, all are promising fields for the introduction of bamboo.

The largest grove now in existence in America is located a few miles from Savannah, Ga. It covers more than an acre, and the jointed stems rise from forty to sixty feet in the air. It has been weathering variations in temperature for more than a quarter of a century. Another large grove, near Bakersfield, Calif., sprang from a single plant bought a dozen years ago from a Japanese nurseryman in San Francisco. In Florida, near Crescent City, a plantation of Bengal bamboo has been supplying fishing poles to anglers of the region for more than a decade. Experiments have revealed that bamboo from the Bengal region of India is particularly suited to the soil and climate of Florida.

The quality of the bamboo varies according to the soil in which it is grown. Potash and phosphoric acid are needed to produce strong, tough wood. For edible bamboo, light, sandy soil is best.

WHILE some species thrive in wet soil, most do best in well-drained, fertile fields. The roots, penetrating to a depth of four feet or more, obtain all the moisture necessary from ordinary rainfalls. Impervious clays and hardpan must be avoided. Once the bamboo grove has established itself, the care involves only a slight expense. And, in the Orient, a well-established grove sometimes brings an annual return of thirty or forty dollars an acre.

Bamboo is not raised from seed. Rhizomes, or sections of the underground stems, are planted like asparagus roots and produce the new canes. Nurseries usually ship them out in late February or March, before the roots become active. They are set out in rows, about two feet apart, after having been soaked in water for two hours. During the early months, water is more necessary than it is later on. The roots are sprinkled at frequent intervals as insufficient moisture at this stage is one of the chief causes of failure. Aside from watering, the only (Continued on page 132)

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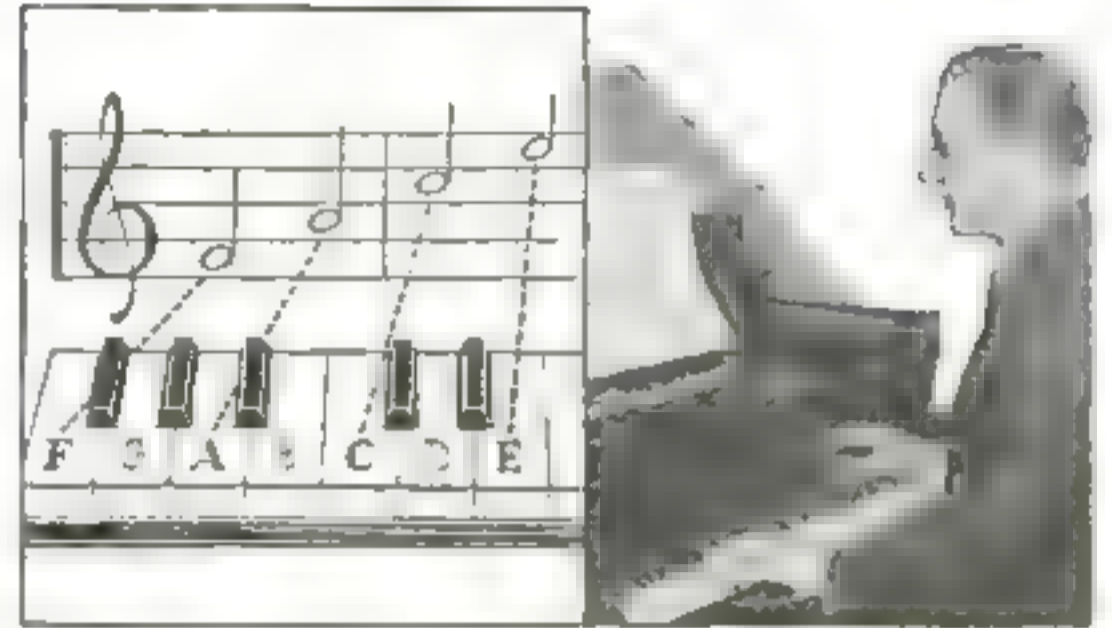
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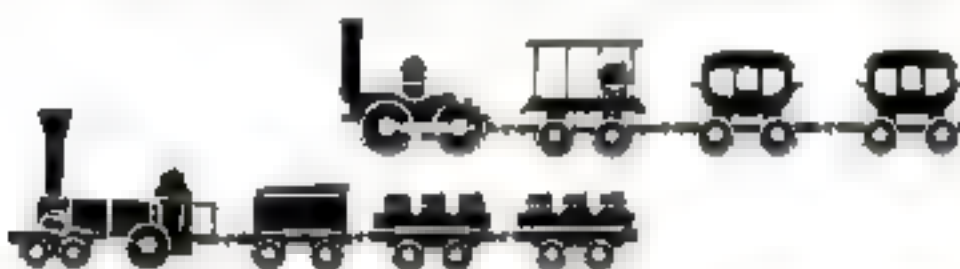
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AMERICA GROWS BAMBOO

(Continued from page 131)

attention required is weeding. By the end of the first season, the roots usually have sent up shoots that rise from two to three feet in the air.

In the spring of the second year, the young plants are dug up with balls of earth around the roots, and transplanted from the nursery row to a permanent location. This ground should be well manured and covered, between the plants, with straw. If the soil is dry, the roots are placed well below the surface; if it is wet, mounds are made and the plants put in these.

IN THE case of the giant timber bamboo, the underground stems spread in all directions, sometimes as much as fifteen feet in a single season. It is by spreading and sending up new shoots that the plants produce groves and forests. Consequently, when they are set out, they are placed approximately fifteen feet apart each way. Smaller species of bamboo can be placed as close as eight feet apart with success.

During the first three years, all canes that rise from the roots should be allowed to mature. After the third year, only the strongest and largest of the shoots are left. The others are cut away to give added strength to the most promising sprouts.

If the transplanting to the permanent field has been done properly, shoots twice the size of those growing the first year will appear the second season. Thereafter, the stems appearing year after year will increase in height and diameter until the maximum is reached. For the giant timber bamboos, this sometimes takes fifteen years; for the smaller species, from five to ten.

A curious and little-understood fact is that the bamboo poles never get any larger than they are at the end of the first season. A pine tree or an oak keeps adding to its size year after year. But a bamboo cane shoots skyward at a rate that carries it to its maximum height during the growing season of a single year. And, curiously enough, the stems have the same diameters when only a few inches above the ground that they have when fullgrown.

From five to ten years is the average life of a bamboo cane. Its maximum hardness is not reached until the third year. If it is cut before that, the wood lacks strength and durability. If it is left standing longer than the fourth year, it becomes brittle and unworkable. So full of minerals are the hard, flinty, outer fibers of the bamboo that oftentimes sparks shoot from the wood when it is cut with an ax.

Because the bamboo adds no growth year after year, its age can only be guessed at. Slow-growing trees produce growth rings which can be counted to determine the age of the wood.

August is the month when the bamboo usually is harvested. Some species are biennial, sending up new shoots only every other year. But most bamboos produce an annual crop which can be cut the second season afterwards. Years ago, it was thought that bamboo had to be harvested while green. Now, it is known that best results are obtained by letting the stems dry before the work of felling begins.

ONCE a bamboo grove is well established, it continues to produce as many as 100 canes a year for half a century. After the first two years, it demands little if any attention. Only when the roots are getting started, is there need for watering, weeding, and cultivation.

According to one official of the Department of Agriculture, poultry and bamboo raising would form an ideal combination. The tall, slender stems of the bamboo, with their feathery

(Continued on page 133)



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AMERICA GROWS BAMBOO

(Continued from page 132)

branches at the top, would provide shade for the chickens and the poultry would add to the income while the groves were getting established.

In addition to the giant timber bamboo, and smaller wood-producing species, government officials are introducing other types as ornamental plants for windbreaks, hedges, and gardens. They have been popular in England and on the Continent for several decades and are admirably suited for use in America.

Recently, new types of bamboo, brought home from all parts of the tropical world by Department of Agriculture plant hunters, have been forwarded to the Savannah station. Planted in clumps and marked with metal tags, they are being watched to learn the peculiar characteristics of each. Out of such tests, carried on over a long period of years, the government scientists expect to discover the ideal bamboo for southern planting.

THE bamboos under government propagation range in height from one to fifty feet. The edible bamboo, suitable for introduction in South Atlantic and Gulf Coast states, is one of the most beautiful forms of the plant. Like the other hardy species, it spreads out to form groves. The canes, or stalks, of all bamboos, with the exception of the black-spotted or black bamboo, are green as they grow, turning yellow as they dry out.

Some years ago, a strict embargo was placed by the Government upon the importation of all bamboo plants from abroad. The step was taken to prevent plant pests from entering the country. Since then, only Government or nursery stock has been available. There are several sources within the borders of the United States where the plants can be obtained at the present time.

The following commercial nurseries, for instance, are mentioned by the U. S. Department of Agriculture, as supplying the giant timber bamboo plants:

Coastal Plains Nursery, Blackshear, Ga.; Elm-Abode Nurseries, Columbia, S. C.; Fant's Greenhouse, Anderson, S. C.; Fruitland Nurseries, Augusta, Ga.; Glen Saint Mary Nurseries Company, Glen Saint Mary, Fla.; H. G. Hastings Company, Atlanta, Ga.; Jungle Gardens, Inc., Avery Island, La.; Royal Palm Nurseries, Oneco, Fla.

The U. S. Department of Agriculture station which supplied free stock for bamboo plots is located at Chico, Calif., 140 miles north of San Francisco. The larger bamboos were supplied in lots of not less than twenty-five at a time. Some of the smaller varieties were shipped in lots of ten or fifteen plants. In either case, the weight of the shipments ran to about a pound for each plant. Shipments went by express, collect.

INFORMATION on the propagation of bamboos, based upon years of research by Government experts, is also available for those interested in establishing nurseries. The Office of Foreign Plant Introduction of the Department of Agriculture in Washington, D. C., has charge of this service.

Throughout the world, approximately 500 species of bamboo have been studied and classified. More than two thirds of them are natives of Asia and the adjacent islands. Every year, from these lands, thousands of miles of bamboo canes travel by steamer to the United States to meet the needs of sport and industry.

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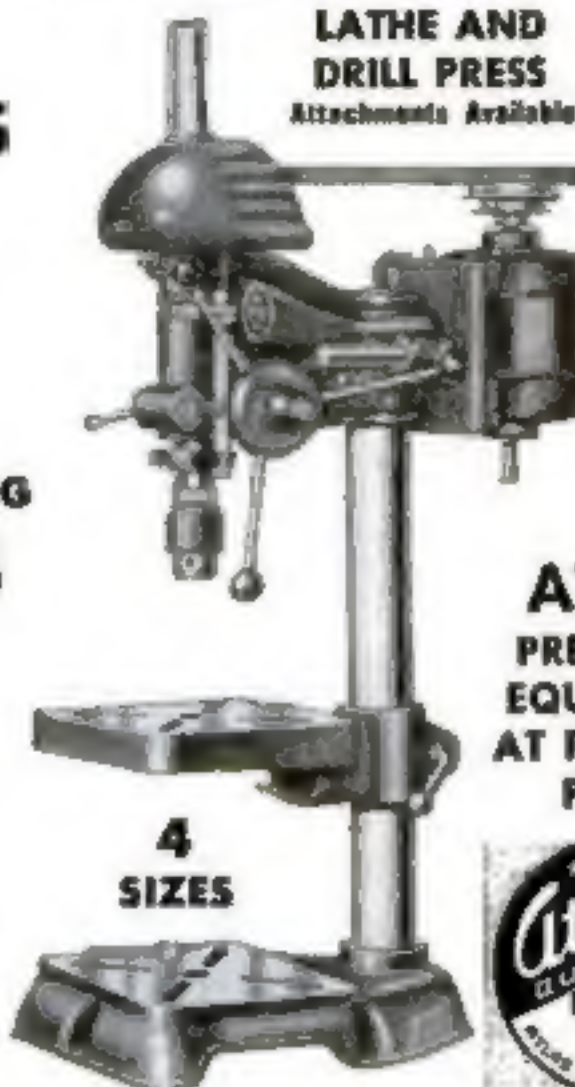
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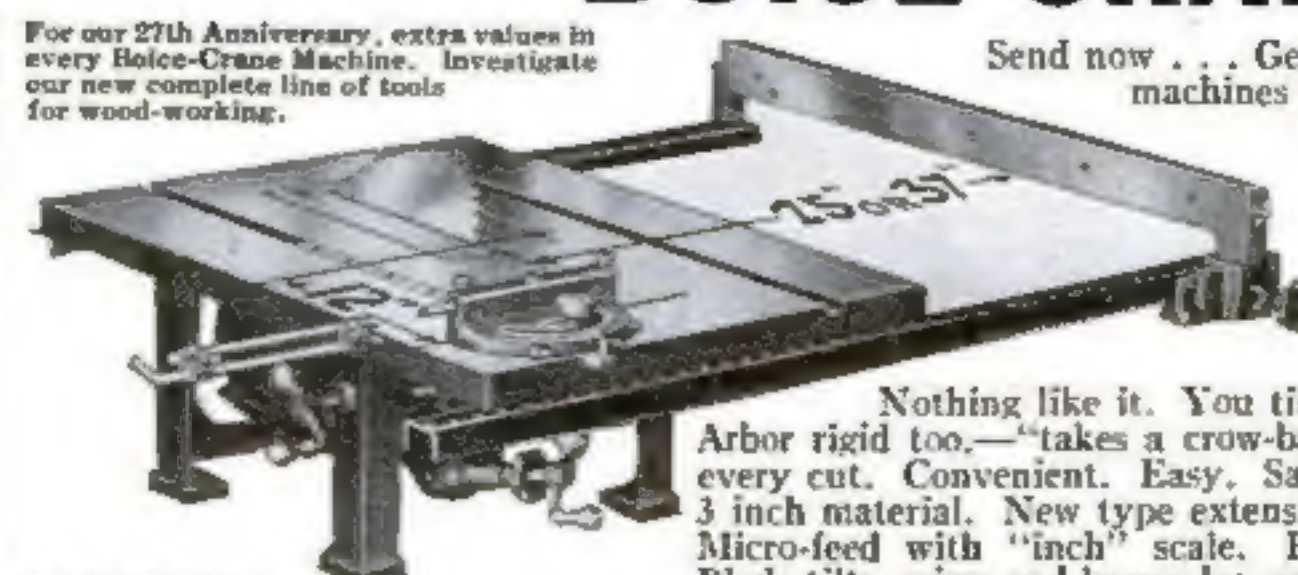
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Photographing the Dionne Quintuplets

(Continued from page 33)



An Ontario policeman removing the film from a camera which a visitor has taken into the playground gallery. Light spoils any pictures made

are used by advertisers who, incidentally, contribute substantially to the quins' bank account for the privilege.

One of the official photographer's most difficult tasks is to convince customers that the kind of pictures they want simply cannot be made by an ordinary mortal. To get all five babies to pose in certain positions, and to have each baby doing a specific thing is—well, impossible. Such specifications may be met by spending several days photographing the babies one at a time, and then assembling the individual pictures into a group.

PHOTOGRAPHS Davis makes of the Dionne quintuplets are permitted by an exclusive contract between his employers and the guardians of the babies. No one else can legally make such photographs. The exclusiveness of the pictures Davis obtains makes them highly valuable to their owners, and to the babies themselves. A manufacturer may pay a small fortune for an endorsement involving the use of a picture of the babies in advertising his product. The result of the present photographic tie-up between the guardians of the babies and the makers of still and moving pictures will be that, by the time the quintuplets have grown up, they will be among the wealthiest sisters in the world.

This explains the precautions taken to prevent outsiders from photographing the babies. Many an uninformed tourist has taken his camera along on his pilgrimage to Callander in the hope of getting a good snapshot of the quins, only to have it taken from him at the gate to the viewing gallery; or, if he did manage to get it inside, to have it seized and the film taken out and exposed to light.

Today, it is just about as easy for an outsider to get a good photograph of the Dionne quintuplets as it would be for him to photograph the internal details of a battleship. There are lots of things he can record with his camera in the vicinity of the nursery, but they do not include the famous quins.

Although the strict regulations concerning the photographing of the babies might seem, at first sight, to be a conspiracy against tourists, such is not the case. Actually, it is a means by which future abuses of a privilege, already spoiled by the inevitable few, may be checked. The holders of the exclusive photo contract at first allowed tourists to snap souvenir pictures for their own use. Before the present play yard was completed, visitors could get to within a few feet of the quintuplets when they were being exhibited to the public, and it was relatively easy to get snap-

shots of them. Eventually, however, it was noticed that such pictures were being published in various forms, evidence that professional photographers as well as tourists were snapping shutters. And so there came into being the elaborate system that now guards the Dionnesisters against picture taking of all kinds.

The babies are exhibited to visitors twice a day, weather permitting, in a play yard flanked on three sides by a specially constructed observation gallery. Visitors are admitted, free of charge, to this gallery as many times as they desire. The lineup of visitors gener-

ally looks like a sizable parade. Six or seven thousand persons a day is not an unusual attendance record.

The tourist displaying a camera, whether it be a cheap box or expensive miniature, is stopped at the outer gate by boys who remind him that no cameras are allowed inside. These are the check boys who will take care of the camera while its owner goes through the play ground building. Identifying numbers are chalked on each camera and tickets are issued. The visitor does not have to take advantage of the checking service: he can return his camera to his car, or have a friend hold it for him.

But maybe the tourist has a small camera that he can conceal under his coat. The policeman who officiates at the entrance turnstiles may spot the suspicious bulge, and turn the visitor back. Several signs prominently displayed proclaim that any person with a camera will be refused admittance to the playground observatory. Once in a while, some one succeeds in taking his camera inside and snapping the quins at play, through the observation windows. Almost always a guard spots him, and seizes the camera. The guard removes the film in daylight, which spoils any pictures it may have recorded.

But the chances are that, even if the visitor does succeed in stealing a shot of the babies and getting his camera safely through the guard lines, he will get little reward for his

troubles. The play yard of the quins can be seen from the observation galleries only through windows covered, on the outside, with aluminum-coated wire screen of fine mesh. The babies, in the well-lighted play yard, cannot see their visitors because the aluminum wire reflects so much light that it appears opaque. When an attempt is made to take a picture through the windows from the gallery, the wire screen acts as a diffusion screen that effectively kills detail. The negative produced, if it shows anything at all, is so fuzzy and indistinct as to be almost worthless. Davis, with better equipment than most visitors, and unhampered by guards, has not succeeded in making anything but hopelessly fuzzy photographs through the wire.

In going from the nursery to the play yard, the five babies and their nurses must pass across an open space. It is then that the visitors get their first glimpse of the babies; and it is then that many camera shutters click, from outside the outer steel guard fence. But here again such clicking produces disappointing results, for a "snow fence," made of small palings, has been strung along the inner steel protective fence, to form an effective antisnapshot screen.

Outside the fence that separates the nursery and play yard from the rest of the little village that has sprung up around the Dionne home site, the visitor with a camera can shoot pictures to his heart's content, without fear of interference if he doesn't climb on top of things where, with the aid of a telephoto lens, he might shoot down into the yard.

THE subjects most often photographed by tourists include the Dafoe nursery and play yard exterior, the unpainted home where the quins were born, and, of course, the trim little house of Doctor Dafoe, nestling behind its picket fence on the road that carries the endless stream of cars to the nursery. Some fortunate visitors have been able to get the older Dionne children to pose on the porch, and answer questions in French, while shutters are snapped.

It is apparent that, for some time to come, the quintuplets will be photographed successfully only by their privileged still cameraman, and occasionally by a motion-picture photographer who is making a newsreel or feature photoplay in which they appear. But if you are fortunate enough to visit Quintuplet Land, don't leave your camera at home on that account. Just check it at the gate while you take the short but unforgettable journey through the unique observatory building.



This is what you get if you try to snap a picture of the quins through the "snow fence" that surrounds an open space they cross daily. Small palings inside the wire fence blur the camera's view

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